RESOURCE MANAGEMENT ASSOCIATES
of Madison, Inc.

PD-ABK-570
93470

TECHNOLOGY TRANSFER FOR ENERGY MANAGEMENT PROJECT

FINAL REPORT

Prepared for:

U.S. Agency for International Development

Prepared by:

Resource Management Associates of Madison, Inc.
520 University Avenue
Madison, Wisconsin, 53703
U.S.A.

December 6, 1990

TABLE OF CONTENTS

LIST OF TABLES and FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY i

1.0 INTRODUCTION 1

2.0 PROJECT GOALS AND OBJECTIVES 2

3.0 PROJECT ACCOMPLISHMENTS 5
- 3.1 National Energy Impact 5
- 3.2 Specific Project Accomplishments 7
  - 3.2.1 TTEM Project Management 7
  - 3.2.2 Financial Management 7
  - 3.2.3 DLF Subprojects 9
  - 3.2.4 Marketing and Promotion 14
  - 3.2.5 Performance Monitoring 16
  - 3.2.6 Training and Institutional Development 17
  - 3.2.7 Technical Assistance 18
  - 3.2.8 Commodity Procurement 19
  - 3.2.9 Energy Conservation Policy Development 19
  - 3.2.10 PLDT Cogeneration Study 20

4.0 EVALUATION OF PROJECT ACCOMPLISHMENTS 22
- 4.1 National Energy Impact 23
- 4.2 Specific Project Objectives 25
  - 4.2.1 TTEM Project Management 25
  - 4.2.2 Financial Management 27
  - 4.2.3 DLF Subprojects 28
  - 4.2.4 Marketing and Promotion 30
  - 4.2.5 Performance Monitoring 31
  - 4.2.6 Training and Institutional Development 31
  - 4.2.7 Technical Assistance 32
  - 4.2.8 Commodity Procurement 33
  - 4.2.9 Energy Conservation Policy Development 34
  - 4.2.10 PLDT Cogeneration Study 34

5.0 INSTITUTIONALIZATION OF TTEM 36
- 5.1 Institutionalization Study and Recommendations 36
  - 5.1.1 Recommended Immediate Institutionalization Option 36
  - 5.1.2 Institutionalization of an Expanded Project 37
- 5.2 Institutionalization Plan 38
- 5.3 Status of Institutionalization 38

6.0 LESSONS LEARNED DURING PROJECT IMPLEMENTATION 40
6.1 The TTEM Project 40
6.2 USAID Energy Conservation Projects 41

7.0 RECOMMENDATIONS FOR FUTURE PROJECT DEVELOPMENT 43

b

LIST OF TABLES and FIGURES

1. Magnitude of Project Outputs Anticipated in Project Paper 4
2. Significant Milestones of the TTEM Project 6
3. Estimated DLF Reflows 10
4. DLF Subprojects by Technology 12
5. Current DLF Projects - Energy and Monetary Savings 13
6. DLF Subproject Status 15
7. Comparison of TTEM Project Outputs 22
8. Projected Energy Savings of DLF Subprojects from Project Paper 24
9. Comparison of DLF Subprojects by Technology to Project Paper Expectations .. 29

Figure 1: Existing Organizational Structure of TTEM Project 8

LIST OF APPENDICES

A. Resource Documents Reviewed
B. Excerpts from USAID Project Paper
C. Participating Financial Institutions
D. DLF Subproject Descriptions
E. Project Outreach and Information Dissemination
F. TTEM Staff Training
G. RMA and Contractor Reports
H. Technical Assistance Provided by TTEM
I. Short-term Consultant Trips
J. Commodity Procurements
K. Excerpts from RIG/A Audit Report
L. List of Acronyms and Abbreviations

Table D1: Monitoring and Case Study Plan for DLF Subprojects

C

EXECUTIVE SUMMARY

The Technology Transfer for Energy Management (TTEM) Project is a pioneering effort to promote the adoption of energy conservation technology within a developing country. At the time of project design, no similar effort had been implemented in a developing country. The TTEM Project's design was based on successful energy conservation programs and experiences from a number of industrialized countries.

The primary purpose of the TTEM Project is to promote and accelerate the adoption of innovative energy-efficient technologies and operational practices by industrial and commercial establishments. Secondarily, the project seeks to establish a strong institutional capacity to undertake and manage conservation-related investments and programs, especially in private sector engineering firms, industrial and commercial facilities, equipment vendors, and other related service firms. TTEM's overall goal is to increase the energy efficiency of conventional industrial and commercial energy use through widespread adoption of energy-efficient technologies, thereby reducing dependence on imported oil, conserving foreign exchange, and improving the overall economic and financial position of Philippine firms.

TTEM was designed to overcome inherent barriers to energy conservation that exist within the Philippines. The main barriers, as identified in the Project Paper, were: 1) the lack of widespread information on the technical and economic feasibility of innovative energy-efficient technologies; 2) the lack of training and experience of local Philippine technical expertise in this area; and 3) the lack of available capital for energy conservation investments due to competition with more traditional investments, such as industrial capacity expansion.

The implementation of the TTEM Project has successfully served to carry out its overall goal and purpose. TTEM has successfully proven that the concept of a Demonstration Loan Fund (DLF) program for energy conservation projects is an effective means for overcoming barriers to conservation implementation in industry. The project has accomplished four major goals:

1) **Establishment of the DLF Program** - Nine private financial institutions (PFIs) have been certified and trained in administering the DLF loans. Acceptance within the financial community of energy conservation projects has been successfully promoted.

2) **Disbursement of the USAID Grant** - Nearly all of the grant funds have been committed to nineteen energy conservation projects. The reflow pool of capital funds has already started to grow, and part of this fund is planned to be committed for one additional subproject, which was unable to be completed by the USAID Project Assistance Completion Date.

3) **Support Activities** - Technical assistance, training, and information dissemination of energy conservation technologies have been successfully developed and implemented through the project.

4) **Institution Building** - The infrastructure built up to implement the TTEM project under USAID funding can be used for continued project implementation under the management of OEA. OEA has initiated the institutionalization process and a bill is now before Congress which would enact the continuation of TTEM into law.

National Energy Impact

The energy and cost savings of the TTEM project have made a significant contribution toward reducing the national dependency on imported fuel, as shown by the figures below.

ANNUAL ENERGY SAVINGS

1.	Oil	
	-Bunker C	1,872,000 liters
	-Diesel	427,300 liters
	-LPG	310,250 kgs
2.	Coal	3,750 MT
3.	Wood/Bagasse	24,000 MT
4.	Electricity	10,055,000 KWH
Total Barrels of Oil Equivalent		78,500 BOE
Total Monetary Savings		P 43,900,000
Foreign Exchange Savings		$US 2,543,000

ELECTRIC POWER IMPACT

1. Reduction in Electric Demand	2.0 MW
2. Additional Cogeneration Capacity	1.3 MW

The TTEM project has made a significant contribution toward reduction of energy and dependency on imported fuel oil. The foreign exchange savings alone are approximately

US$2,543,000. The total annual energy savings from 20 DLF subprojects is expected to be 78,500 BOE per year, which is more than five and one half times greater than was projected in the TTEM Project Paper. The energy savings for only 20 projects is about 0.02% of the total oil consumption of the industrial sector in 1989 (77.2 million BOE). Although this savings appears small as a percentage of total energy consumption, it is a significant start towards greater energy conservation.

A World Bank-funded study, as part of the Technical Assistance Component of the Second Structural Adjustment Loan Project, estimated the potential energy conservation of eight different industries to be 5.5 MBOE and identified 450 potential projects. This represents about 5 percent of the total 1989 energy consumption and almost 7 percent of the 1989 industrial oil consumption. The total estimated investment required for implementing these projects is P9.41 billion. Since these estimates only take into account a small portion of the industries, the potential for industrial and commercial energy conservation is likely to be much greater. If TTEM could continue at a larger scale, large strides in achieving this energy conservation potential could be made.

Currently, oil rationing is part of a plan for energy conservation in the Philippines. This has caused major upset in the Philippines and will cause major financial loss for businesses. Since crude oil prices have already risen in the past months and rationing will also push the prices up even further, a reduction in demand is crucial. To avoid future energy crises of this type, and to keep the negative financial effects of power and fuel shortages to a minimum, it is important that energy conservation programs have longer term objectives and effects. TTEM has proven to have played an important role in accelerating the adoption of energy conservation. With additional funding, energy conservation potential could be more fully realized.

Specific Project Accomplishments

TTEM Project Management

The TTEM Project staff were successfully assembled. In addition, a Steering Committee was formed to lend overall direction to the project, and a Subproject Selection Committee was formed to aid in project review and selection. This project management team worked well together to achieve the project's goal and objectives and displayed considerable initiative in pushing the project along. These key management groups will continue to function under the institutionalized TTEM program.

DLF Subprojects - A total of 30 technology demonstrations were accomplished within twenty approved DLF subprojects, nearly 80% of the 38 envisioned in the original project paper. The primary reasons for the reduced number of projects are: 1) Lack of funds, and 2) Lack of time for the project to develop a wider base of smaller projects. The approved projects were found to have excellent financial performance, with an average payback of 2.5 years and an average internal rate of return of better than 40 percent. Most of the targeted

technologies were utilized by at least one project, with the exception of insulation for commercial applications and building energy management systems.

Financial Management

The DLF mechanism was developed and lending procedures established. Nine PFIs are accredited to participate in the program. All loans are currently in good standing with no defaults or late payments. There was sufficient interest by the PFIs and the industrial community to commit nearly all of the USAID DLF grant of $2,435,000. The process of certifying the PFIs, setting the interest rate, and the lending guidelines worked adequately well. The loan limit of $200,000 was considered by PFIs and clients to be too low for most industrial energy conservation projects, and should be raised substantially to fund larger projects.

Marketing and Promotion

An intensive effort was made to market the DLF and energy conservation awareness. Marketing was conducted in commercial and industrial firms in all areas of the country. Information on energy conservation and the TTEM subprojects was disseminated through seminars, marketing calls, association meetings, PFIs, and the TTEM Channel newsletter. Because the project start was delayed, marketing was targeted primarily to large projects. A much more intensive marketing effort would have been required to attract small projects. Promotion activities through local business groups and the media were marginally effective in generating projects. Promotion of energy conservation technologies and TTEM through technical seminars and short-term consultant visits were judged to be very effective. Some of the PFIs also were useful in marketing TTEM, as five DLF subprojects were generated through them. If the loan limits had been higher, PFIs would likely have played a greater role in this area.

Performance Monitoring

Ten of the twenty DLF subprojects were completed early enough in the project to begin performance monitoring. Six projects are far enough along in the monitoring stage to have case studies completed. TTEM will continue project monitoring and information dissemination in 1991.

Training and Institutional Development

By the end of 1990, TTEM had co-sponsored over 25 seminar/workshops on selected energy conservation technologies, in various parts of the country. Nearly 1100 participants, consisting of plant managers/engineers, equipment suppliers, finance executives and technical consultants, attended the seminars. In addition, ten trainees were brought to the U.S. for four-week intensive training programs, and one attended a six-week course. Training was also provided locally for TTEM and OEA staff. The training would have been

more effective had it occurred earlier in the project. Training benefits may be lost with the departure of many members of the senior and junior staffs.

Technical Assistance

TTEM staff have provided technical assistance in the form of energy audits, feasibility analysis and other consultations to over 120 firms. Time and resources limited the staff from providing the level of technical assistance requested by the industrial and commercial community. This great need for technical assistance could have been met by additional technical resources if local subcontracts had been set up to provide additional support. Request for Proposals (RFPs) for local technical support were issued too late in the project and were complicated by administrative, legal, and contractual issues.

RMA provided approximately 14 person-months of short-term consultants and 45 person-months of long-term technical assistance. This assistance was generally successful, although more preparation for the short-term trips, on the part of TTEM and the RMA Resident Advisor, would have made the short-term technical assistance more effective. The Resident Advisor's technical assistance to the staff and DLF clients was crucial to the project's success. Because of the heavy administrative burden of the project, the RMA Resident Advisor should have had an administrative assistant. This would have allowed him to concentrate on providing technical assistance.

Commodity Procurement

Commodities purchased with project funds included a project vehicle, computer equipment and software, energy audit instrumentation and equipment, and library materials. Energy audit equipment and the project vehicle were generally appropriate and were very important to all project activities. Some of the audit equipment was not well utilized by the staff, because of its advanced technical nature. Training on this equipment for OEA should be given to ensure the subproject monitoring is conducted well. Another vehicle would have benefitted the project; site visits were often limited due to the unavailability of transportation. Computer software should have been considerably expanded to include monitoring and performance evaluation software.

Energy Conservation Policy Development

Three main policy areas and studies were addressed during the TTEM project, 1) tax-free importation of energy efficient equipment, 2) institutionalization of TTEM, and 3) study of energy conservation policies. Although more effort could have been focussed on this area, the work that was done was timely and will likely have a large impact on the future of TTEM and energy conservation in the Philippines.

TTEM was instrumental in obtaining registration from the Board of Investments (BOI) to allow tax-free importation of several types of energy conservation equipment, which benefitted six TTEM subprojects.

RMA and the Private Development Corporation of the Philippines conducted the study of the institutionalization of TTEM. This has been very important to setting up the continuing TTEM project under OEA.

RMA also conducted an energy conservation policy study for OEA and USAID which addresses policies in the areas of energy price restructuring, fuel taxes, import duties on imported energy efficient equipment, buy-back purchases from private power producers, energy use standards and energy regulatory reform. This study was intended to identify policies which could be adopted by the Government of the Philippines (GOP) to further energy conservation and was well received by OEA and USAID. The GOP has proposed an energy conservation bill which called for implementation of energy use standards; adoption of TTEM into OEA; greater government financing of energy conservation measures, and other policies promoting energy conservation. If this is passed, this will be a good start at implementing the policies recommended in the RMA study.

Philippine Long Distance Telephone Company (PLDT) Cogeneration Study

RMA has undertaken a detailed study of PLDT switching centers to determine the feasibility of installing cogeneration units. PLDT plans to install units in two of those facilities. The design and procurement specifications have been completed for two packaged cogeneration units. They are expected to deliver: 1) 35 tons of air conditioning and 100 kw of power and 2) 100 tons of air conditioning and 300 kw of power. The two units have the potential to be replicated in 85 and 55 PLDT facilities, respectively. As part of this program, training on all aspects of developing cogeneration projects was conducted with two PLDT engineers in the U.S.. Continued USAID/PLDT jointly funded technical support in the procurement of these units will allow this technology to be demonstrated to other firms in the Philippines. In addition, USAID could support additional feasibility studies of this type and a study of the cogeneration market potential in the Philippines.

Institutionalization of TTEM

At the request of OEA and USAID, RMA conducted a study in the first quarter of 1990 on institutionalization of the TTEM project. The study's objective was to recommend an effective structure for continuing the work of TTEM following the withdrawal of official USAID assistance. The results and recommendations of the study were adopted by the Steering Committee and a plan of action for implementing these was established. The plan included: 1) Establishment of a trust fund with the Development Bank of the Philippines for the DLF reflows; 2) Continuation of a TTEM staff within the OEA Conservation Division; 3) Establishment of an operating budget for TTEM within OEA; 4) Continuation of project monitoring and information dissemination activities by TTEM staff; 5)

Development of an overall plan of TTEM activities; 6) Increased private sector involvement; and 7) Additional donor funding to expand the DLF. All of these measures will be initiated by the PACD, but no additional funding for the project has been located to date.

Lessons Learned During Project Implementation

Based on the experience of the past four years, we believe that efforts of the institutionalized TTEM program should be concentrated on the following: 1) Continued use of the DLF to finance demonstration projects at a concessionary interest rate; 2) Marketing emphasis on the cost-savings realized through energy conservation investment, instead of the DLF; 3) Expanded technical assistance and information dissemination which focuses on the completed subprojects; 4) Establishment of a system to follow-up on firms provided with technical assistance to determine whether energy conservation investment was made as a result of TTEM, and to identify whether replication of subprojects is taking place; 5) Greater reliance on the private sector for technical assistance, auditing and marketing functions, possibly through a cost-sharing grant mechanism; 6) Coordination with OEA, other government agencies and TTEM, and additional USAID funding for the further development of policies to promote energy conservation; and 6) Additional donor country and multilateral loan funds to support the above activities.

Some broader "lessons" have been learned which may be applicable to future USAID energy conservation project development. These include the following:

1) Since energy conservation projects take a substantial effort and time to start up, and implementation of TTEM-type technologies in industry can take up to three years, the project term should be at least 7 years. This will allow replication to become more widespread.

2) Consistent and long-term commitment and direction from USAID is very important for effective project implementation.

3) A higher level of funding will allow more large-scale technology projects to be implemented and have a greater impact on reducing energy consumption.

4) A self-evaluation system, conducted on a regular basis, should be built into a project and should include a component which elicits feedback from project clientele. This is very important to improvement of the project during implementation, and is invaluable for follow-on projects.

Recommendations for Future Project Development

The TTEM project has been successful at reducing energy consumption in Philippine firms, and has gained substantial momentum. It is recommended that USAID consider providing

follow-up technical and financial assistance to ensure the continuation of the program. Rather than providing complete start-up support, USAID's assistance would be channeled only to those areas where OEA is still weak. In particular it is recommended that:

1. OEA would assume a more proactive role in management and administrative areas.

2. USAID support would be channelled primarily to providing specific technical expertise, and in supplementing the DLF fund with additional capital.

3. USAID support should also be provided for implementation of specific actions on the part of GOP to promote energy conservation, primarily through development and implementation of definitive GOP policy.

In order to accomplish these actions, USAID would need to develop a specific Project Assistance Paper. RMA would recommend that the following essential elements be included in the paper: 1) An assessment of the market potential for energy conservation which would compile and expand upon previous studies to be used in marketing and determining additional disbursements to the DLF; 2) Identification of areas providing specific technical assistance to OEA; 3) Funding for increasing and improving outreach activities of OEA; and 4) Specific measures to increase the technical capability of the country's own resources, thus lessening the dependence on foreign consultants.

The Project Assistance Paper would also address an expanded in-country study on policy development involving active local policy-makers and contain a plan for program assistance based on these policies.

1.0 INTRODUCTION

The Technology Transfer for Energy Management Project (TTEM) provides technical assistance and funding for the implementation of innovative energy conservation technologies in industrial and commercial establishments in the Philippines. The five-year TTEM project is supported by a $4.6 million grant from the U.S. Agency for International Development (USAID) and by in-kind contributions from the Office of Energy Affairs (OEA), Government of the Philippines (GOP), the implementing organization for the project (formerly the Bureau of Energy Utilization). The Project Agreement was signed with the GOP in September, 1985 and amended in August 1986 to convert the loan portion to grant. Project implementation was delayed due to the 1986 change in the government of the Philippines and the resultant government reorganization. In December, 1986, USAID contracted Resource Management Associates of Madison, Inc. (RMA) to provide technical and management assistance to TTEM. This assistance included the services of a Resident Advisor for the four year project implementation, as well as short-term expertise and home office support in various technical areas.

The Final Report is a description and evaluation of the accomplishments of the TTEM Project. This report was prepared from project documents including RMA annual and monthly reports, short-term consultant trip reports, the institutionalization study, TTEM staff project summaries, and various activity reports. A listing of these reports is included as Appendix A. Section 2.0 contains an overview of the project and its objectives; followed in Section 3.0 by a cumulative summary of project accomplishments. Section 4.0 provides an evaluation of TTEM accomplishments as viewed from the perspective of the contractor. Section 5.0 discusses the institutionalization of TTEM and the steps which have been taken to insure project continuation beyond the end of official USAID involvement in the current project. Section 6.0 discusses lessons learned from TTEM and how they might apply to other USAID projects. Finally, Section 7.0 concludes with recommendations for future project development.

The OEA, TTEM and USAID staff contributed greatly to the TTEM project and the conceptual content of the Final Report. RMA however assumes full responsibility for the conclusions expressed in this report.

2.0 PROJECT GOALS AND OBJECTIVES

The TTEM Project is a pioneering effort in promoting energy conservation technology since no similar project had been implemented in a developing country. The project design was based on successful energy conservation programs from a number of industrialized countries. Essential features, project targets and appropriate technologies, defined with the assistance of GOP and USAID officials, were based on the experience of industrialized country programs of the late 1970s and early 1980s.

The primary purpose of the TTEM Project, as stated in the project paper, is "to promote and accelerate the adoption of innovative energy-efficient technologies and operational practices by energy consumers who are heavily dependent on fossil fuels and electricity, especially in industrial and commercial buildings. Secondarily, the project seeks to establish a strong institutional capacity to undertake and manage conservation-related investments and programs, especially in the private sector. This capacity is to be developed among industrial and commercial energy consumers, suppliers of equipment and services, engineering firms specializing in energy conservation, lenders, and government policy-makers. TTEM's goal is to increase the energy efficiency of industrial and commercial energy users through widespread adoption of energy-efficient technologies, thereby reducing dependence on imported oil, conserving foreign exchange, and improving the overall economic and financial position of the Philippine businesses". (USAID 1985)

During the project identification phase of TTEM, the following barriers to energy conservation investment in the Philippines were identified:

- Energy consumers' lack of awareness of energy conservation technologies;
- Skepticism about the economic and technical performance of conservation technologies;
- Lenders' perception of the high risk of energy conservation investments;
- Competition for scarce investment capital with more traditional investment in capacity expansion;
- Loan "packaging" problems resulting from the small capital requirement of some conservation investments;
- Shortage of domestic suppliers of both equipment and services needed to implement conservation measures.

The following key project components were designed to overcome these barriers:

1. Demonstrations - to show the technical and economic viability of energy efficient technologies which have not been widely implemented in the Philippines.

2. Seminars and Workshops - to provide increased awareness and understanding of energy conservation options for plant managers, technicians, suppliers, engineers, financial institutions and improved local technical expertise. These would also serve to promote TTEM.

3. Staff training - to improve institutional capacity for the evaluation and implementation of energy efficient technologies and to improve project management.

4. Study missions - to measure energy intensities and to identify potential energy conservation investments in representative firms.

5. Technical studies - of various energy conserving technologies to identify and provide information on those with the greatest potential for demonstration.

6. Policy Studies - to increase the awareness of the future role of energy efficient technologies and management systems and to identify those policies which will further encourage energy conservation.

7. Innovative financing mechanisms - through local banks to demonstrate that energy conservation technologies are viable investments and are not as high a risk as perceived.

8. Funding - to provide additional capital for the perpetuation of energy conservation investment and to increase awareness of private financial institutions and international donors.

For those key project components which are easily quantifiable (e.g. demonstrations, training, and studies), USAID estimated a magnitude of output. The target outputs were identified within the budget, staffing, and time constraints for the five year life of the project (LOP). Appendix B contains excerpts from the Project Paper which document project outputs and budget. Table 1 describes the expected magnitude of the outputs.

TABLE 1

MAGNITUDE OF PROJECT OUTPUTS
ANTICIPATED IN PROJECT PAPER

Component	Number
Demonstrations	38
Seminars/Workshops*	80
Staff Training	70
Study Missions	30-40
Technology Studies	70
Policy Studies	10

* Average seminar/workshop would have 20 attendees, plus technicians trained in demonstrations - approximately 1600 during LOP.

Source: USAID, TTEM Project Paper, Appendix B, 1985.

After four years of project implementation, TTEM has retained its original goals and objectives, thus demonstrating that the project goals and objectives were well-designed. This is attributed in large part to the involvement of local parties in the project identification and design phases (ENMAP, BEU, PCCI, Philippine Banks, plant managers). Project components and the individual outputs of each are described and evaluated in Sections 3.0 and 4.0, respectively.

3.0 PROJECT ACCOMPLISHMENTS

The TTEM project has successfully accomplished many of the objectives that were established in project design. Most importantly, it has been very successful in achieving the larger goals of the project. Table 2 shows the most significant milestones of the five year project and demonstrates the accomplishments achieved. These accomplishments are described in detail in this section.

3.1 National Energy Impact

The TTEM project has made a significant contribution toward reducing the national dependency on imported fuel. In fact, the foreign exchange savings alone are estimated to be $2,542,525 per year; which is 55% of USAID's investment in the program. A summary of the national energy impact is as follows:

ANNUAL ENERGY SAVINGS

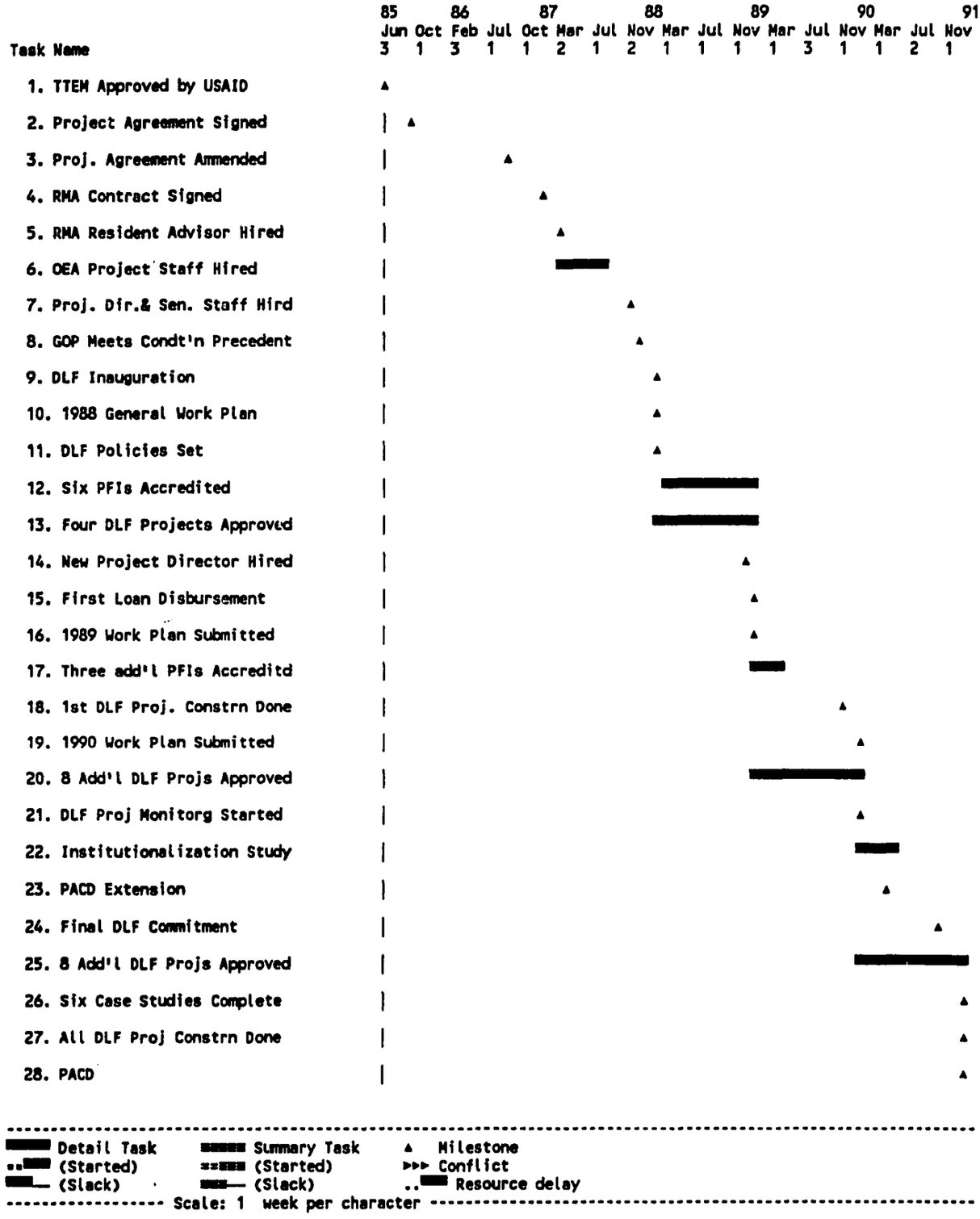
1.	Oil	
	-Bunker C	1,872,019 liters
	-Diesel	427,270 liters
	-LPG	310,250 kgs
2.	Coal	3,746 MT
3.	Wood/Bagasse	23,981 MT
4.	Electricity	10,054,954 KWH
Total Barrels of Oil Equivalent		78,473 BOE
Total Monetary Savings		P 43,900,000
Foreign Exchange Savings		$US 2,542,525

ELECTRIC POWER IMPACT

1. Reduction in Electric Demand	2.0 MW
2. Additional Cogeneration Capacity	1.3 MW

It should be noted that this energy reduction and foreign exchange savings is just for the twenty demonstration projects. As the full potential of replication is realized throughout the country, these savings will be multiplied many times over. The potential for replication is discussed in Section 4.1.

TABLE 2: SIGNIFICANT MILESTONES OF THE TTEM PROJECT



3.2 Specific Project Accomplishments

The following subsections provide comprehensive descriptions of the accomplishments of the TTEM project from its implementation in early 1987 to the present. The subsections are delineated according to specific project tasks which are part of meeting the objectives of TTEM.

3.2.1 TTEM Project Management

Management of the TTEM project is concentrated within three areas: 1) Overall project direction is provided by USAID, OEA and the Steering Committee; 2) Day-to-day management of the project comes primarily from the Project Director and TTEM Senior Staff, with assistance from the RMA Resident Advisor and OEA Conservation Division; and 3) Selection of subprojects is reviewed by the Subproject Selection Committee. The project has been established as an autonomous unit within the OEA Conservation Division, but is reliant on the Division for support and direction. An organizational chart (Figure 1) illustrates the project management structure of TTEM.

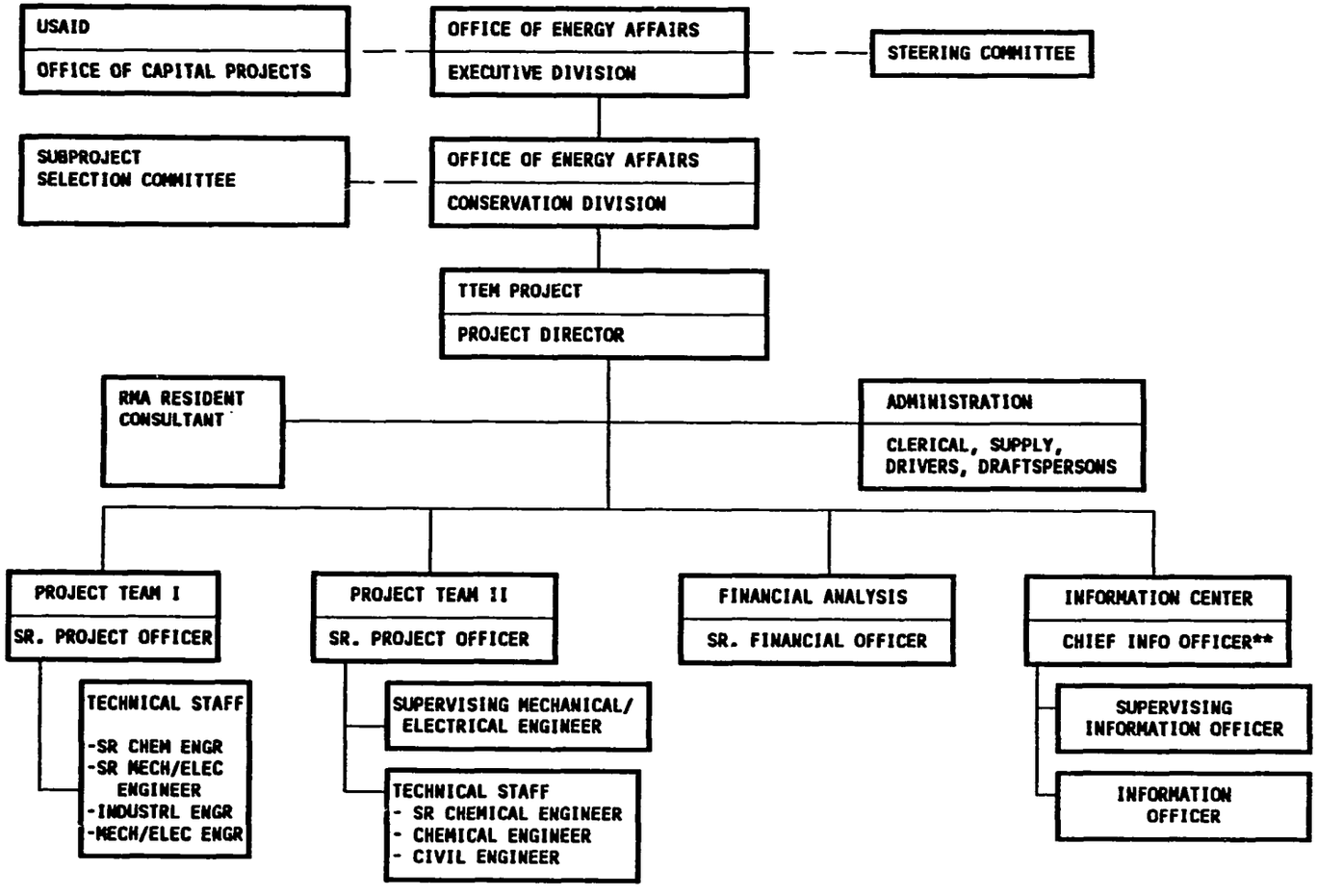
Component tasks of the day-to-day management of the project include marketing the DLF; providing of technical assistance to client firms; development and evaluation of potential subprojects; technical assistance in construction and start-up; and, monitoring and dissemination of information on each completed subproject. The full-time contractual staff (or Junior Staff) were hired during the period February to July, 1987, and the first Project Director and Senior Staff were hired by November, 1987. The technical staff were split into two project teams, each headed by a senior staff engineer. Responsibility for each subproject was assigned to one of the project teams. Project planning sessions were held each year to review the status of the project and to set targets for the upcoming year.

3.2.2 Financial Management

Originally, the DLF was allocated $2,760,000 to finance demonstration loan projects. During the course of the project, $325,000 was deobligated by USAID, reducing the available loan fund to $2,435,000. The funds were allocated in support of loans to qualified companies to implement demonstration energy conservation technology projects. The project agreement also contained provision for grant funds to be awarded to participating companies for project monitoring equipment. Currently, the DLF commitments stand at $2,350,088 or 96.5% of the allocated funds. It is anticipated that $2,014,790 will be disbursed before the USAID Project Assistance Completion Date (PACD), while the balance will be disbursed by USAID upon verification that the projects were completed by December 31, 1990.

Nine Participating Financial Institutions (PFIs) were accredited by TTEM as the mechanism for distribution of the loan fund (see Appendix C for a listing). The PFIs have responsibility for credit analysis, disbursement of funds from the Central Bank (CB) to the clients, and

FIGURE 1: EXISTING ORGANIZATIONAL STRUCTURE OF TTEM PROJECT



*** Steering Committee is a 10 member committee with representatives from OEA, BOI NEDA, CB, DOI, DBM, PCCI, ENMAP, BAP and TTEM Project Director. USAID Representative and RMA Resident Consultant are non-voting members.**

**** This position is currently not filled.**

collection of the loan repayments. The PFIs also provided assistance in marketing the DLF to bank clients interested in implementing energy conservation projects. TTEM staff have provided training to the PFIs on energy conservation technologies and the requirements of the DLF, to facilitate their participation.

The DLF interest rate policy was developed early in the project. The method utilized until the second quarter 1990 was based on the Manila Reference Rate (MRR) as follows: the interest rate was set at the previous three months average of the 90 day MRR (MRR 90) plus 3%, provided that this rate was not lower than MRR 180 plus 1%. The rate was established at the Steering Committee meeting and remained in effect until the Steering Committee changed it. The policy worked reasonably well during the period of moderately rising interest rates. However, early in 1990, interest rates began to fluctuate sharply and the interest rate setting formula sometimes actually resulted in higher rates than conventional short term rates available to borrowers. The policy was changed to the following: MRR 180 plus 1% averaged over the week that the project was approved. This revised policy allowed the interest rate to be set on a weekly basis and enabled the borrower to still obtain a somewhat concessionary rate.

As client firms repay the DLF loans, principal and interest reflows are deposited into an account at the Central Bank (minus CB and PFI fees). Currently, the reflows are being invested in high-yielding short-term interest bearing notes. However, the reflows will soon be transferred from the Central Bank to the Development Bank of the Philippines (DBP), where a trust fund will be set up for the continuation of TTEM activities. These activities will include demonstration loans, post-installation monitoring, administrative expenses, and information dissemination of the case studies of the DLF subprojects and other energy efficient technologies. Table 3 illustrates the estimated reflows and potential lending capability of the institutionalized TTEM DLF, based on full fund disbursement. The actual reflows will be slightly less, since not all of the DLF was disbursed by the PACD. Without additional capital infusion, the fund will be able to support only a small number of new projects and a minimal amount of technical support.

3.2.3 DLF Subprojects

The most important objective of the TTEM project is the development and implementation of the DLF subprojects. The TTEM staff identify subprojects through marketing and technical assistance in industrial and commercial facilities. The client, with TTEM staff, conducts a preliminary feasibility study and, if the project is economically advantageous, the client completes a TTEM funding application. A comprehensive feasibility study is then conducted by the client with support from TTEM staff and/or other local engineers. The TTEM staff perform a detailed evaluation to verify the subproject feasibility. The subproject evaluation, if it passes TTEM project criteria, is then presented to the Subproject Selection Committee for approval.

TABLE 3: ESTIMATED DLF REFLOWS

ALL FIGURES IN THOUSANDS OF PHILIPPINE PESOS

	1989	1990	1991	1992	1993	1994	1995
PRINCIPAL REPAYMENTS							
NEW CASH INFUSIONS		0	0	0	0	0	0
ORIGINAL REFLOWS		2,843	8,520	11,053	12,764	11,038	4,245
NEW LOANS			869	2,669	5,464	9,325	13,455
SUBTOTAL		2,843	9,389	13,722	18,228	20,363	17,700
INTEREST PAYMENTS							
ORIGINAL LOANS		2,307	3,036	2,394	1,620	769	125
NEW LOANS			350	989	1,852	2,870	3,617
A ANNUAL INVESTMENT INTEREST		108	136	238	245	175	343
SUBTOTAL		2,415	3,522	3,621	3,717	3,814	4,085
EXPENSES							
OEA ADMINISTRATION		0	2,000	2,200	2,420	2,662	2,928
ANNUAL FUND ADMINISTRATION		31	60	85	107	114	108
SUBTOTAL		31	2,060	2,285	2,527	2,776	3,036
FUND BALANCE BEFORE LOANS	904	6,132	11,983	17,041	21,460	22,860	21,609
LOANS ISSUESD		5,000	10,000	15,000	20,000	20,000	20,000
BALANCE AFTER LOANS ISSUES	904	1,132	1,983	2,041	1,460	2,860	1,609

ASSUMPTIONS

1. ALL EXISTING FUNDS DISTRIBUTED IN 1990 (SEE NOTE BELOW)
2. INVESTMENT INTEREST 12% OF PREVIOUS YEAR BALANCE
3. 7% INTEREST ON LOAN FUNDS
4. OEA ADMINISTRATIVE EXPENSES INCREASE AT 10% ANNUALLY
5. 0.5% ANNUAL FUND ADMINSITRATIVE EXPENSE

NOTE: ACTUALLY ONLY $2,350,088 OF THE DLF WAS COMMITTED; $2,014,790 WILL BE DISBURSED IN 1990 AND THE BALANCE WILL BE DISBURSED IN 1991.

A detailed description of each of the twenty subprojects funded by TTEM is given in Appendix D. The descriptions include: 1) company background and financial standing; 2) DLF subproject description and status; 3) project cost and economic assessment; 4) expected energy and monetary savings; and 5) the potential national impact of the project. Appendix D also includes Table D1 which depicts the monitoring and case study plan for each subproject.

Table 4 shows the subprojects which were funded by the DLF, according to technology type. The total number of demonstrations is greater than the number of loans, due to the existence of more than one technology demonstration in some projects.

Table 5 provides more detailed information for each subproject, specifically the technology, total project cost, loan amount, estimated energy savings by fuel type; total estimated monetary savings; expected payback period; and estimated internal rate of return for each project.

As shown in Table 5, the total loan fund that has been committed by OEA is P 52.7 million, equivalent to US$ 2.35 million, for projects with a total investment of nearly P 103 million. The estimated investment cost of the DLF subprojects ranged from P 0.68 million to P 19.2 million, with an average investment of P 5.1 million. The average DLF loan was P2.6 million, generally 55% of the total project cost. Eight projects out of twenty required the maximum loan of US$ 200,000. This loan amount represented less than the allowable DLF contribution. Thus nearly half of the DLF subprojects could have benefitted from a larger loan fund.

The total energy savings resulting from all TTEM subprojects is expected to be 78.5 KBOE per year beginning in 1991, about 0.2% of the total petroleum products consumed by industries in 1989. Although this savings appears to be small, the potential for energy conservation from replication and future TTEM projects is significant. The annual fuel savings are estimated to be 23,981 MT of wood, 3,746 MT coal, 2.6 million liters of fuel oil, and 10,055 MWH of electricity. The approximate reduction in electric power demand is estimated at 2 MW. The two cogeneration projects are expected to add electric power capacity of 1.3 MW. These are significant contributions to electric power in a country facing severe electricity shortages, and more importantly, serve as demonstrations to other power users.

The expected monetary savings are substantial, P 43.9 million, equivalent to more than US$2 million. The average IRR for the subprojects is better than 40%, an excellent return on investment for all projects. This is especially favorable when compared to the average interest rate for DLF subprojects of about 17% and the prevailing commercial market rate between 20 to 26%. The payback period for individual DLF subprojects ranged from 0.6 to 4.7 years and averaged 2.5 years. This data shows that the technologies implemented with TTEM funding are very attractive for investors.

TABLE 4

DLF SUBPROJECTS BY TECHNOLOGY

Technology	Number	Clients
Combustion Monitoring and Controls	2	UGCC, ALSONSII
Flue Gas Heat Recovery	1	UGCC
Power Factor	5	BENGUET I,CADP,CEPALCO, ILPI, TIPCO
Insulation-Industrial	7	RCC,ARTIMCO,RWPI, UGCC,ALSONSII,MVC,SUPERPLY
Steam Systems	5	ARTIMCO,RWPI,ALSONSI, MVC,SUPERPLY
Chiller Optimization and Controls	1	PLDT
Cogeneration	2	BELL, CFIC
Process Improvement	7	RCC,CEPALCO,AMAC, BENGUET II,BCI,ILPI,KSLI
Total	30	

TABLE 5: CURRENT DLF PROJECTS - ENERGY AND MONETARY SAVINGS

COMPANY	TECHNOLOGY	TOTAL PROJ. COST (MP)	LOAN AMOUNT (MP)	LOAN AMOUNT ($ '000)	EXPECT WOOD(b) SAVINGS (MT/YR)	EXPECT COAL SAVINGS (MT/YR)	EXPECTD FUEL OIL SAVINGS (KLTRS/Y	EXPECTD ELECTRICI SAVINGS (MWH/YR)	TOTAL ENERGY SAVINGS (BOE/YR)	TOTAL MONETRY SAVINGS (MP/YR)	EXPECT PAYBAK PERIOD (YEARS)	EXPCT IRR (%)
1. BENGUET I	Power Factor Correction	0.69	0.5	24.7				530.0	869.3	0.6	1.1	93.5
2. CADP	Power Factor Correction	0.68	0.5	24.2				78.9	129.4	0.4	1.8	64.5
3. PLDT	Chiller Controls	6.4	4.2	199.5				593.8	973.9	1.4	4.7	16.5
4. RCC	Waste Heat Recovery	7.7	4.3	200.0		2650		321.1	8874.1	3.4	2.3	43
5. CEPALCO	Electrical Loss Reduction	5.7	4.2	199.6				2145.1	3517.9	1.4	4.1	20.1
6. AMAC	Process Modification	5.9	4.2	196.8			(853.9)	4260.9	1617.0	2.7	2.2	45
7. ARTIMCO	Steam Systems Improvement(a)	2.3	1.7	86.2	5482				7674.8	1.3	1.8	53.4
8. CFIC	Cogeneration	19.2	4.2	190.7	2173		341.3		5189.0	11.5	1.7	59.5
9. Benguet II	High Efficiency Motors	0.95	0.7	31.6			394.7	(1436.9)*	125.9	0.6	1.5	65.6
10. RWPI	Boiler Load Optimization	4.07	3.0	135.4			523.7	224.9	3662.8	1.6	2.6	36.7
11. UGCC	Waste Heat Recovery/Comb. Ctrl	15.5	4.3	198.9			1423.3		8952.6	4.0	3.8	22.5
12. BELL CARP	Cogeneration(c)	1.16					119.3		750.1	0.3	4.0	23.1
13. Bacnotan	Process Controls	1.6	1.2	54.2		1096			3868.9	1.4	1.9	43.8
14. ILPI	Voltage Improvement	6.12	4.1	178.1				1760.4	2887.1	3.0	2.0	49.1
15. TIPCO	Power Factor Correction	3.74	2.8	106.2				947.6	1554.1	1.5	2.5	38.6
16. ALSONS I	Steam System Improvement(a)	4.47	3.3	131.0	7817				10527.4	1.7	2.6	36.4
17. ALSONS II	Boiler Controls	2.04	1.5	57.7	2598			353.8	4217.4	0.7	2.9	32.6
18. MABUHAY	Steam System Improvement	0.87	0.65	25.0			426.0		2679.5	1.4	0.6	192.5
19. KALINISAN	Process Modification	10.18	4.7	200.0	2996		266.3	275.2	6320.7	3.6	2.8	33.8
20. SUPER PLY	Steam System Improvement(d)	3.53	2.6	110.3	2915				4081.0	1.3	2.6	36.2
	TOTAL	102.8	52.7	2350.1	23981	3746.0	2640.7	10054.9	78472.9	43.9		
	OVERALL AVERAGE	5.1	2.6	117.5							2.5	40.7

(a) Excludes a grant component of P 150,000
(b) Conversion of waste wood to BOE at 1.4 MT wood/BOE
(c) The loan amounts have been removed from this table because it will be funded by reflows after the PACD.
(d) Excludes a grant component of P 120,000
* Additional electricity used for new motors.

As of September 30, 1990, eight of the subprojects have installed and tested their equipment, and are fully operational. Four subprojects are in the installation stage; two are in the process of purchasing equipment; three are in processing by the PFIs; and three are expected to be reimbursed in 1991, after completion by December 31, 1990. Table 6 shows the status of the DLF subprojects as of the completion of this report. This table also indicates the length of time required for completion of each subproject; some required one to two years for implementation.

3.2.4 Marketing and Promotion

The TTEM staff conduct marketing analyses to identify those industries which could potentially apply the selected TTEM energy conservation technologies. A considerable amount of effort was expended in the first three years of the project to raise awareness of the benefits of energy conservation, and to promote the DLF. Appendix E contains a comprehensive listing of marketing and promotion activities during the life of the project.

Marketing and outreach is facilitated through promotional seminars, conferences, seminars for lenders and vendors/suppliers, and direct sales calls. The promotional seminars are offered to plant managers and engineers from various industrial firms for whom TTEM staff present project services and the eight candidate technologies to be demonstrated with DLF funding. TTEM staff also market the project through technical conferences offered in association with ENMAP and other organizations.

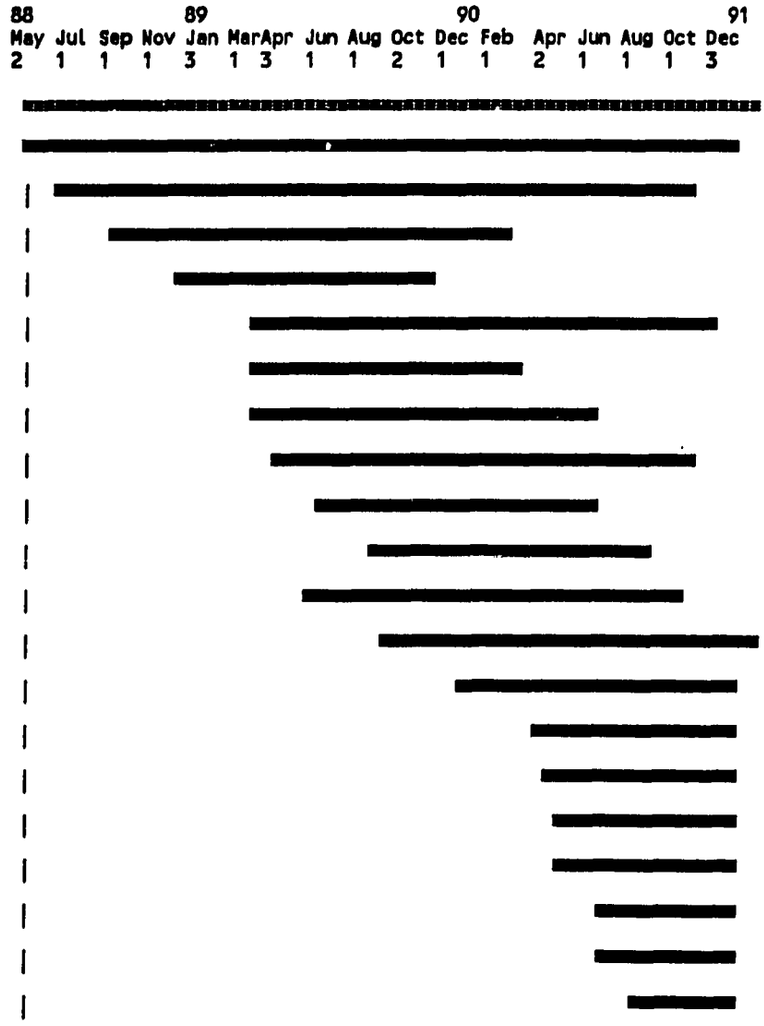
In 1987, potential clients were contacted through letters, presentations, exhibits, and site visits. The outreach which took place in this year was broadly targeted, in an attempt to get the maximum exposure for the project. By 1988, the Senior Staff were on board for the entire year, which facilitated the development of a more organized system of market research and identification of potential clients. The TTEM staff conducted 107 marketing calls to potential clients during 1988. The marketing calls generally included a discussion of potential energy conservation projects specific to the firm, as well as a briefing on the funding available for projects. Many of the marketing calls were followed up by energy audits, conducted by the OEA audit team or by TTEM staff, to identify specific DLF subprojects for funding. The TTEM staff also expanded efforts to market outside of the Metro Manila area by visiting many firms in communities outside of Metro Manila. TTEM orientation seminars were conducted in Davao City, Cagayan de Oro, and Cebu in conjunction with local business associations.

Twenty-nine of the 107 client contacts made in 1988 had potential energy conservation projects; eleven of which qualified for DLF funding (four subsequently availed of the DLF loans). Ten of the identified projects were funded by the firm and, in some cases, obtained technical assistance from TTEM. Four of the projects did not qualify for DLF funds.

In 1989, TTEM staff established the target of marketing the DLF to 150 firms. They exceeded this target and contacted 158 firms, 68 of which were outside Metro Manila.

TABLE 6: DLF SUPROJECT STATUS

Task Name	Start Date	End Date
DLF FUND	17-May-88	31-Jan-91
PLDT	17-May-88	31-Dec-90
BENGUET I	30-Jun-88	31-Oct-90
CADP	19-Sep-88	1-Mar-90
REP CEMENT	7-Dec-88	3-Nov-89
CEPALCO	21-Mar-89	30-Nov-90
ARMCOSTEEL	21-Mar-89	12-Mar-90
ARAS-ASAN	30-Mar-89	14-Jun-90
CENT FERM	27-Apr-89	31-Oct-90
BENGUET II	19-Jun-89	15-Jun-90
RUBBERWORLD	25-Aug-89	4-Sep-90
UNION GLASS CC	5-Jun-89	17-Oct-90
BELL CARPETS	19-Sep-89	31-Jan-91
BACNOTAN	2-Jan-90	31-Dec-90
ILIGAN L&P	2-Apr-90	31-Dec-90
TRUST INT	16-Apr-90	31-Dec-90
ALSONS I	1-May-90	31-Dec-90
ALSONS II	1-May-90	31-Dec-90
MABUHAY VINYL	2-Jul-90	31-Dec-90
KALINISAN	2-Jul-90	31-Dec-90
SUPER PLYWOOD	15-Aug-90	31-Dec-90



Detail Task — Summary Task — ▲ Milestone
(Started) — (Started) — ▸▸▸ Conflict
(Slack) — (Slack) — Resource delay

Scale: 2 weeks per character

NOTE: PLDT's project implementation is longer than the other projects due to construction delays.

Fifteen DLF applications were generated from this outreach effort, five short of the target for the year. Nine DLF subprojects were evaluated and approved for funding, of which four received funding in 1989, including one project which was subsequently withdrawn.

TTEM staff have also presented seminars to the PFIs, providing them with information on the technologies, the services offered by TTEM staff, and the DLF. Many PFIs play an important role in marketing the DLF to their clients. In addition, TTEM staff market to vendors/suppliers. Of the approved DLF subprojects, five were referred by PFIs and another five were referred by equipment suppliers.

In 1990, with the PACD very near and the DLF significantly depleted, TTEM staff concentrated on follow-up marketing calls on the companies previously identified as having energy conservation projects. The number of follow-up calls conducted in 1990 was 31. In addition, twenty new companies were contacted for 1990.

Information dissemination of TTEM activities and energy conservation technologies is facilitated by distribution of the quarterly *TTEM Channel* newsletter and TTEM press releases. The *TTEM Channel* is distributed to 400 organizations, including potential clients, industry associations and other interested parties. Ten issues have been distributed as of October 1990.

Six case studies are scheduled to be completed prior to the PACD. As of the issuance of this report, four have been completed. The dissemination of the case studies on energy efficient technologies should assist in the promotion of energy conservation and encourage replication of the subprojects. These completed projects will also enhance the marketing ability of TTEM by providing operational examples of these technologies which potential client firms can view.

In November 1990, TTEM participated with ENMAP and UNESCO in a seminar entitled "Economic and Financial Evaluation of Energy Conservation Investment Projects". The seminar provided a forum for TTEM to present project results and the institutionalized TTEM program concept to potential firms.

Finally, the TTEM project staff developed an audio visual presentation that was used successfully at many seminars, promotional meetings, etc. The program was revised in 1989 and additional audio visual equipment was purchased.

3.2.5 Performance Monitoring

Performance monitoring is a joint effort between TTEM staff and the client firm implementing the DLF subproject. TTEM has assisted these companies by establishing monitoring procedures and documentation; conducting regular site visits to review and gather baseline and performance data; supplying field monitoring instrumentation; and in

some cases, allocating DLF grant funds for the company to purchase and install permanent monitoring instrumentation.

Ten of the twenty approved DLF subprojects had been completed early enough to begin performance monitoring in 1990 (see Table D1, Appendix D). The remaining projects will be monitored in 1991 under the OEA institutionalized TTEM program. Six projects are far enough along in the monitoring stage to develop case study presentations. These are:

1. Republic Cement Corporation (waste heat recovery)
2. Central Azucarera Don Pedro Sugar Mill (power factor correction)
3. Armco-Marsteel Alloy Company (process modification)
4. Aras Asan Timber Corporation (steam system improvement)
5. Central Fermentation Industrial Corporation (cogeneration)
6. Rubberworld, Inc. (boiler load optimization)

One of the main tasks of TTEM staff in 1991 will be to continue with the DLF subproject monitoring and to disseminate the case study results to encourage replication.

3.2.6 Training and Institutional Development

TTEM has sponsored a series of technical educational programs which took place in Manila and other in-country locations over the past three years. These courses were typically taught by a U.S. consultant in conjunction with TTEM staff and/or local consultants. Each course focused on a particular technology such as waste heat recovery, cogeneration and building energy management systems. Typically, one or two major seminar/courses per year were offered to plant managers, OEA staff and other interested parties.

By the end of 1990, TTEM had co-sponsored a total of 26 seminar/workshops on selected energy conservation technologies, in various parts of the country. A total of 1086 participants, consisting of plant managers/engineers, equipment suppliers, finance executives and technical consultants, attended the seminars. The co-sponsoring agencies typically provided logistical and marketing support.

TTEM and OEA staff also participated in seven technical training programs in the U.S. (see Appendix F). Ten trainees were brought to the U.S. for four-week intensive training programs, and one attended a six-week course. The U.S. training programs were tailored specifically to a particular technical topic through a combination of formal courses, site visits and individualized training sessions. Each training trip ended with the production of a trip report which documented the training and evaluated its success in meeting training program objectives.

In addition to technical training in the U.S. and the Philippines, a training seminar in computer-based project management, using Timeline Software, was conducted in the Philippines for TTEM and OEA staff. The final element of staff training included several

local courses attended by TTEM staff (see Appendix F). This training furthered the technical and management expertise of the staff.

The RMA Resident Advisor worked daily with TTEM staff to upgrade their capability in project implementation, and to provide training and expertise in project management, energy engineering and performance monitoring. The Resident Advisor also provided expert advice to client firms interested in implementing energy conservation projects.

3.2.7 Technical Assistance

Technical assistance offered by TTEM consists of three primary functions: 1) industrial extension; 2) energy auditing; and, 3) feasibility analysis.

Industrial extension provided by TTEM staff has included providing technical information on specific technologies and equipment availability in response to technical requests. The TTEM staff maintain an up-to-date library of vendors contacts for energy conservation equipment, and information on technologies to provide to interested parties. If specific technical requests can not be answered by TTEM staff or local consultants, RMA is subsequently contacted to provide technical assistance. A listing of the project documents resulting from the technical requests directed to RMA is given in Appendix G.

Energy auditing services were provided to client firms as time and personnel resources would allow. Seven energy audits were conducted in 1989 and six in 1990. This service was especially important to firms lacking the resources to evaluate potential energy conservation projects on their own, and helped motivate firms to invest in energy conservation. The OEA Conservation Division was also involved in performing energy audits for potential TTEM clients. Energy audits provided the information necessary to identify and evaluate potential energy conservation projects. The baseline information obtained as a part of the audit was also used in performance monitoring and determination of the actual energy savings.

TTEM staff generally assisted the client firms with the DLF application and evaluation of the energy savings potential of the project. For the more sophisticated projects, TTEM assisted with a feasibility analysis. Following the application submission, TTEM staff prepared a formal evaluation of the project and presented this to the Subproject Selection Committee for approval. Continuing technical assistance was provided by TTEM during the implementation phase of the project, and in establishing the monitoring program. Technical assistance, provided to thirty-six firms in 1988, fifty-five firms in 1989, and twenty firms in 1990, often involved an energy audit, feasibility study or visit by a U.S. consultant. A comprehensive listing can be found in Appendix H.

Short-term consultants utilized by the project provided valuable technical input to the identification of projects through site visits to potential clients. RMA provided a total of 14 person months of short-term technical assistance to the project, and 45 person-months

of long-term technical assistance. A listing of the short-term consultant trips can be found in Appendix I.

3.2.8 Commodity Procurement

The TTEM technical assistance contract contained a limited budget for the procurement of commodities necessary for implementation of the project. Equipment purchased for TTEM includes the following:

Project Vehicle (van) & spare parts	$20,765
Computer Equipment/Software	6,196
Energy Audit Instrumentation & Equipment	33,079
Library Materials	6,232
Miscellaneous Office Equipment	1,670
Total	$67,942

This equipment was necessary for implementation of the project. Additional computer and audio visual equipment was supplied to TTEM utilizing separate USAID TTEM project funds. A detailed listing of commodity procurement is included in Appendix J.

3.2.9 Energy Conservation Policy Development

The project paper recognized that energy policy is an important tool in encouraging energy conservation. Energy conservation policies could also support and promote the activities of TTEM. The GOP, at the time of project adoption, was reorganizing its institutional structure for identification, promotion, and implementation of energy conservation policies. TTEM conducted a number of activities to strengthen and expand energy policy.

In 1989, TTEM was instrumental in obtaining the inclusion of several new energy conservation technologies in the Investment Priorities Plan of the Board of Investments. This allowed DLF clients to obtain duty-free importation of their equipment, when necessary. Obtaining this status entailed a fairly lengthy and detailed registration process, which was often facilitated by TTEM staff. Six TTEM clients availed of the tax-free importation benefit.

TTEM also worked with the monetary board to attain exemption status for the DLF from the Central Bank's legal reserve requirements and exclusion from the bank's risk assets. This made the DLF more attractive to PFI's.

In the first quarter of 1990, RMA, with the assistance of the Private Development Corporation of the Philippines, conducted a study which examined the options for institutionalization of TTEM. The study provided an overall assessment of TTEM and made recommendations for institutionalizing TTEM and energy conservation in the

Philippines. The study results, the institutionalization plan and status are described more fully in Section 5.0.

A recent House Bill ("An Act to Institutionalize Energy Conservation and Enhance Efficient Use of Energy"), introduced by Congressman Herminio Aquino, addresses the problems associated with the severe electric power shortage and higher oil prices. Provisions of the bill include establishment of an institutionalized TTEM program within OEA, specifically the administration of the DLF. This provision was in response to the institutionalization plan for TTEM which was included in the Bill. Other notable parts of the proposed bill call for 1) government-owned and controlled financial institutions to set aside funds to provide concessional rate loans for energy-related and energy conservation projects; 2) establishment of energy use standards for oil-powered or electrical-driven machinery and equipment; and 3) a number of other policies promoting energy conservation.

In October 1990, RMA conducted a policy study for OEA which addressed energy conservation issues. The principal recommendations of the study are:

1) Energy pricing which reflects long-run marginal cost;
2) Energy efficiency standards for specific industrial/commercial equipment and buildings;
3) Elimination of import tariffs on energy efficient equipment and cogeneration units, as well as tax credits for this equipment;
4) Establishment of an autonomous energy regulatory commission; and
5) Implementation of demand-side management within a least-cost integrated planning framework.

The study focussed on policies that could be implemented to promote energy conservation and the use of private power producers for electric power supply and identified both long term and short term measures that OEA or others could implement. For example, one of the short term measures suggested is that provisional energy use standards be set for various equipment. The study recommends that TTEM be used to test these energy efficient equipment through its demonstration projects. One of the more important long term recommendations is to establish an Energy Regulatory Commission which is separate from the National Power Corporation (NPC), Philippine National Oil Company (PNOC), and other agencies, to review and set fuel and electricity prices, power purchase contracts between NPC and independent producers, and least-cost energy plans. OEA has been very responsive to this study and is evaluating the recommendations which have the greatest potential for adoption by the GOP.

3.2.10 PLDT Cogeneration Study

The Philippine Long Distance Telephone Company (PLDT) operates over 100 facilities, including 39 automatic telephone exchanges in the Metro Manila area, 74 central offices in the provinces, and 35 microwave relay stations. Each of these facilities has a critical

dependence on electrical energy for operation of telephone equipment, lighting and ventilation, and on electrical or thermal energy for cooling.

The overall objective of this study was to develop specifications for a packaged cogeneration system that could provide reliable, cost effective energy services at various PLDT facilities. The system was to be designed for maximum replicability in as many PLDT sites as possible. This replicability will allow PLDT to install systems at various sites as their budget permits, with minimal cost for site specific engineering, and operation and maintenance training.

The study was conducted in three phases by the RMA short-term consultant and PLDT engineers. Phase I concentrated on the development of a method of data collection and analysis for PLDT facilities, to allow systematic evaluation of cogeneration feasibility at each selected site. Phase II involved the analysis of site data and feasibility analysis of cogeneration system options. Phase III included the selection of the final configuration of two demonstration cogeneration systems, one applicable in PLDT's smaller office facilities and the other in its larger facilities. Procurement specifications were prepared for each system along with a final evaluation of the economic feasibility of each system. Between Phases II and III, two PLDT engineers were brought to the U.S. for a three week training session that involved: 1) meeting with cogeneration equipment suppliers who supply engine/generators, absorption chillers, and packaged systems in the appropriate size for PLDT; 2) site visits to facilities with similar applications to those which would potentially be used by PLDT, to observe system/facility integration, maintenance procedures, and varying system options; and 3) discussions with utilities and regulatory agencies on power purchasing contracts.

4.0 EVALUATION OF PROJECT ACCOMPLISHMENTS

The TTEM Project has met most of the specific objectives outlined in the original project design. More importantly, it is meeting the overall goal of the project, which is to promote and accelerate the adoption of innovative energy efficient technologies in industrial and commercial buildings. Twenty demonstration projects have been approved which are expected to save the Philippines $2,542,525 annually in foreign exchange savings. Other project outputs of training, technical support, and institutionalization have also largely been met or exceeded. While the project has not achieved the quantity of outputs in every area originally contained in the project design, RMA believes the project objectives have largely been achieved.

It is interesting in evaluating the achievement of TTEM to compare the original expectations for project outputs, as defined in the Project Paper, with the actual performance of TTEM, shown below in Table 7. We have also included in this comparison the results of the USAID audit performed in the first quarter of 1990. This helps to illustrate the notable achievements of TTEM that came to fruition in the latter part of the project. These later achievements are in part attributable to the fact that TTEM finally took root within the Philippine financial and business community, after a considerable amount of marketing effort. It is also likely that the auditors had limited time for review and took a narrow view in tabulating project accomplishments. We used the definitions provided in the Project Paper, described in Section 2.0, to measure project accomplishments. A summary of the RIG/A audit is contained in Appendix K.

TABLE 7
COMPARISON OF TTEM PROJECT OUTPUTS

Activity	Project Paper	Audit	Actual
Technology Demonstrations	38	3	30
Seminars/Workshops	80	None	26
Staff Training	70	11	42
Study Missions	30-40	2	25
Technology Studies	70	38	87
Energy Policy Studies	10	1	3

The key project components of the project design, described in the TTEM Project Paper and discussed in Section 2.0, were implemented successfully. The project has five major accomplishments:

1) **Energy Savings** - Annual energy savings are expected to be on the order of 78,472 BOE from the twenty demonstration projects.

2) **Establishment of the DLF Program** - Nine lending institutions have been certified and trained in administering the DLF loans. Acceptance within the financial community of energy conservation projects has been successfully promoted.

3) **Funding of the DLF Subprojects** - Approximately 96.5% of the grant funds have been committed to nineteen energy conservation projects. The reflow pool of capital funds has already started to grow.

4) **Support Activities** - Technical assistance, training, and information dissemination of energy conservation technologies have been substantially completed.

5) **Institution Building** - The infrastructure built up to implement the TTEM project under USAID funding will be continued within OEA.

4.1 National Energy Impact

The TTEM project has made a significant contribution toward reducing energy use and dependency on imported fuel oil. The total annual energy savings from the twenty DLF subprojects is expected to be 78,472 BOE per year. This is 5.6 times more than was projected in the TTEM Project Paper, as shown in Table 8. The energy savings for the twenty subprojects is about 0.02% of the total oil consumption of the industrial sector in 1989 (77.2 million BOE). Although this savings appears small as a percentage of total consumption, it is a significant start towards greater energy conservation. The foreign exchange savings alone are US$2,542,525. The reduction in electric demand of 2.0 MW is quite significant. This is equivalent to more than double the capacity needed by Cagayan Electric Power and Light Co., Inc. (CEPALCO) for distribution to its 40,000 customers.

TABLE 8: PROJECTED ENERGY SAVINGS FOR DLF PROJECTS FROM PROJECT PAPER

TECHNOLOGY	Annual Estimated Savings (BOE)	Number of Projects	Total Projected Annual Savings (BOE)
COMBUSTION CONTROLS			
Small	427.7	3	1283.0
Large	2119.4	3	6358.2
HEAT RECOVERY	427.7	4	1710.6
POWER FACTOR CORRECTION	321.0	4	1284.0
INSULATION - INDUSTRIAL	75.5	4	301.9
STEAM SYSTEMS IMPROVEMENT	18.4	4	73.5
CHILLER CONTROLS	49.6	4	198.4
ENERGY MANAGEMENT SYSTEMS	306.8	8	2454.7
INSULATION - ROOF	24.2	4	96.7
TOTAL	3770.1	38.0	13760.9

The institutionalization study (RMA 1990) revealed that a large number of firms exist which have potential energy conservation opportunities. Though dated, the A.D. Little Study estimated energy savings potential for the industrial sector of 17.4 MBOE within 16 industries and identified over 8,000 small potential projects. This represents about 15 percent of the total energy consumed in the Philippines in 1989 and about 35% of the oil consumed by the industrial sector in 1989. A more recent study, the World Bank funded TAC-SAL study estimated the potential aggregate energy savings of eight different industries to be 5.5 MBOE and identified 453 potential projects. This represents about 5 percent of the total 1989 energy consumption and 7 percent of the 1989 industrial oil consumption. The total estimated investment required for implementing these projects is P9.41 billion. Since these estimates only take into account a small portion of the industrial sector, the potential for industrial and commercial energy conservation is likely to be much greater.

OEA has submitted a proposal to NEDA, to be included on the list of the Medium Term Public Investment Projects, requesting $25 million in funding for the DLF reflows fund to implement more energy-efficiency projects. An additional $2.5 million was requested to cover expenses for project management, technical assistance, training, information dissemination, commodities and project evaluation. Under this proposed project, a total of

60 subprojects could be implemented over a five year period. Seven different technologies could be implemented within these subprojects, individually requiring investments ranging from P1 million (US$ 45,500) to P77.3 million (about US$ 3.5 million). Funding is not as of yet assured for this proposal. This level of funding is still small in view of the investment required to make a significant impact in achieving energy conservation potential.

Currently, oil rationing is part of a plan for energy conservation in the Philippines. A ten percent reduction in oil deliveries, starting October 21, 1990, was ordered by the Energy Operations Board as part of the country's emergency energy conservation program. Since crude oil prices have risen in past months, and rationing will push the prices up even further, a reduction in demand is crucial. The energy situation has caused major upset in the Philippines and will cause major financial loss to businesses. To avoid future energy crises of this type, and to keep the detrimental financial effects of power and fuel shortages to a minimum, it is important that energy conservation programs have longer term objectives and effects. TTEM has played an important role in accelerating the adoption of energy conservation. With additional funding, the energy conservation potential of the Philippines could be more fully realized.

4.2 Specific Project Objectives

4.2.1 TTEM Project Management

The TTEM project management structure has become well-defined and functions smoothly in accomplishing TTEM's objectives. Each entity within the structure has a clearly defined project role and has been effective in carrying out its responsibilities.

The make-up of the TTEM staff is viewed to have had both positive and negative aspects. The staff size was about right for the formation of two technical teams for project development, evaluation and performance monitoring. The Project Director was absolutely critical to the project's success, as demonstrated by the performance failures of the first Project Director. The Senior Financial Officer and Project Officers were also critical to project implementation. The position of Chief Information Officer was vacant for most of the project, and should have been elevated to a senior staff position to attract and retain quality personnel.

Delays encountered in hiring the Senior Staff meant that the project did not really get off the ground until all were on board, nearly one year after the technical assistance contract had been signed. Contracting of the Senior Staff through USAID imposed additional administrative burden on all parties; it may have been preferable for the technical assistance contractor to have done the contracting. The process of using Price Waterhouse to screen and assist in the selection of qualified candidates worked quite well.

The Steering Committee has been effective in its important role. The design of the project recognized the need to involve all major groups who would affect decisions on energy

conservation. Accordingly, the membership of the project Steering Committee included a diverse representation from the government and private sectors, for the development of overall project policies. Similarly, the Subproject Steering Committee functioned well in its role of approving subprojects.

One aspect of the organizational structure of TTEM which perhaps could have been designed more effectively is the position of the TTEM Staff within OEA. While the TTEM Project was situated within the Conservation Division of OEA, its staff were never really a part of OEA, which in some cases hindered cooperative efforts between staffs. This conflict was due in part to the temporary nature of TTEM staff positions, since all staff were contractual employees rather than civil servants. The project was designed with contractual senior staff whose wage scale was necessarily higher than the civil service scale to attract personnel with a high level of technical expertise. Junior staff were hired on a contractual basis because of the "soft" or limited term funding basis. It was difficult to recruit a new and temporary staff for the project, when perhaps OEA could have provided competent existing staff for TTEM. Junior staff did not have optimum technical backgrounds for the project; there should have been more concentration in mechanical and chemical engineering.

OEA has committed to carry on with the institutionalization of the TTEM program, however there may be some difficulty in retaining existing TTEM junior staff. This is primarily due to the fact that OEA will likely not have a guarantee of funding from the GOP prior to the expiration of staff employment contracts. Since this may not be known until after the PACD, some of the staff may find other employment. OEA is doing everything it can to prevent the loss of experienced staff. It is anticipated that the passage of the Energy Bill in November 1990 will assure funding for the program and staff commitments can be made.

In summary, TTEM was effectively organized to identify potential subprojects and to provide technical assistance to potential clients, banks and vendors/suppliers. However, there are certain aspects of the project staffing structure which took time to implement. First, TTEM was required to recruit an entire staff to initiate activities. Second, the contractual status of the staff caused insecurity and instability for staff members, which in some cases such as with the Senior Information Officer, caused positions to remain unfilled. The staff were also paid at a higher rate than OEA staff, in order to attract experienced professional personnel. This caused TTEM to be slightly isolated from OEA. Finally, TTEM will likely be forced to hire a new staff to continue the project beyond December 1990, when the current staff contracts expire, especially since OEA has not identified a means to absorb the current staff at the higher rates they received at TTEM under USAID. Had the staff been more integrated within the OEA structure, it is possible that some of these conditions could have been mitigated. It is recommended that these points be carefully considered in future project development.

4.2.2 Financial Management

TTEM generated sufficient interest by the PFIs and the industrial community to commit $2,350,088, which is nearly all of the $2,435,000 USAID grant to the DLF. There are eligible projects awaiting funding from the reflows. Funding for future projects will be delayed until sufficient funds exist to cover the loan reimbursements.

In general, the financial management of the DLF has worked quite well. The financial terms of the DLF loans, at two to five percent below the prevailing market rate for comparable commercial loans, were only marginally attractive to clients and the PFIs. A lower interest rate would generate much more interest in the DLF. The PFIs viewed the seven percent spread for fulfilling their responsibilities for credit analysis, disbursement of funds and collection of reflows as adequate incentive to participate in the DLF program. The repayment term of five years was also seen as attractive by DLF clients.

By far the largest problem identified by banks, businesses and the TTEM staff is that the loan size is too small for larger projects such as waste heat recovery and cogeneration. On the basis of estimated capital investment for each technology application, a maximum loan amount of $200,000 per project was set during project design. This amount proved to be insufficient for many firms. Additionally, PFIs indicated that such a small loan did not warrant such intensive information and processing requirements. The PFIs were hesitant to spend much administrative effort on marketing and disbursing the loans. Finally, processing time from loan application to disbursement ranged from 90 to 200 days, and was viewed as requiring too much time. The process needs to be thoroughly looked at and adjustments made to reduce the processing time.

It should be noted that the Project Paper envisioned that some loans of less than $15,000 (P 300,000) would be made for projects. It is rare that such small loans are made in the Philippine banking and business community because the returns are not adequate to cover the high loan administrative costs.

The TTEM project design envisioned PFIs utilizing innovative financing schemes, such as loan repayments tied to energy cost savings. However, TTEM workshops and interviews with various financial institutions revealed a distinct preference for granting loans with fixed repayments. The banks generally perceived that it is difficult to disburse loans for newly introduced technologies and attempting to explore innovative financing would only further complicate the process. Later stages of the project should explore creative financing mechanisms, e.g. tying the repayment schedule to simple payback, thus freeing up additional DLF loan funds sooner for other projects.

Finally, goods and services to be acquired with DLF funds were required to be sourced either in the Philippines or the U.S. This requirement resulted in delays in the implementation of subprojects and sometimes required larger capital investment. TTEM borrowers stated that U.S. manufacturers were not well represented in the Philippines

requiring the firms to import the equipment from the U.S., which often caused considerable delays in subproject implementation. A common observation was that U.S. equipment is more expensive than equivalent Taiwanese, Japanese or Korean equipment. Thus, while the loan was offered at slightly concessional rates, this was somewhat negated by the higher equipment cost.

The TTEM project, under OEA, provided the bulk of financial management for this first phase of the project. OEA is not prepared to handle the financial management over the long term, so these functions should be turned over to a financial management institution (DBP) as recommended in the TTEM institutionalization study.

4.2.3 DLF Subprojects

A total of twenty DLF subprojects were approved, which is just over half of the 38 envisioned by the project paper. Since many of the projects were larger than envisioned in the project paper, however, funding was not available for 38 projects. The majority of the targeted technologies were covered by at least one project, with the exception of insulation for commercial building application and building energy management systems. In addition, some projects also included technologies not addressed in the project paper, such as process improvement and cogeneration. Following is a chart (Table 9) which illustrates the number of projects envisioned by the project paper, by technology, and the actual projects which resulted.

Some projects (e.g. UGCC) included more than one technology, so the total number of technology demonstrations exceeds the twenty DLF loans.

In conceptualizing TTEM, it was expected that there would be many attractive subprojects suitable for TTEM demonstration, and that the Subproject Selection Committee would need to be selective in the projects which were to be funded. The evaluation criteria were expected to be used to prioritize subprojects for DLF financing. However, in the initial stages, the DLF available for subprojects exceeded the immediate demand for energy conservation funding. The appraisal criteria are applied to evaluate the merits of a subproject, but have not as yet been used for competitive ranking. The DLF is now smaller than the potential number of subprojects that could potentially avail of the loan, therefore the selection criteria may be used in the future to competitively rank the subprojects for funding.

The TTEM staff subproject evaluations, which are summarized in Appendix D, were sometimes limited at first. The TTEM staff went through a learning period before each of their evaluations gave complete and consistent information. This process could possibly have been shortened by the establishment of a computer-based standard methodology for subproject evaluation at the beginning of the project. The RMA Resident Advisor should have lent more guidance on establishing this system before the first projects were evaluated.

TABLE 9

COMPARISON OF DLF SUBPROJECTS BY TECHNOLOGY TO PROJECT PAPER EXPECTATIONS

Technology	Original	Actual	Clients
Combustion Monitoring and Controls	6	2	UGCC,ALSONSII
Flue Gas Heat Recovery	4	1	UGCC
Power Factor	4	5	BENGUETI,CADP,CEPALCO, ILPI, TIPCO
Insulation-Industrial	4	7	RCC,ARTIMCO,RWPI, UGCC,ALSONSII,MVC,SUPERPLY
Insulation-Commercial	4	0	
Building Energy Mngmt	8	0	
Steam Systems	4	5	ARTIMCO,RWPI,ALSONSI, MVC,SUPERPLY
Chiller Optimization	4	1	PLDT
Cogeneration	0	2	BELL, CFIC
Process Improvement	0	7	RCC,CEPALCO,AMAC, BENGUETII,BCI,ILPI,KSLI
Total	38	30	

There was no system set up to determine whether TTEM motivated energy conservation investments by firms who did not apply to the DLF. TTEM gave technical assistance to many firms, some of which are known to have implemented energy conservation projects. To what extent TTEM assistance was a critical factor in generating investment is not known.

4.2.4 Marketing and Promotion

Since the first six to nine months of the project was spent hiring the Senior Staff, the marketing efforts of the Junior staff were rather disorganized, though broadly based. In the second year, marketing efforts were much more intensive and TTEM was under pressure from USAID to commit the DLF quickly. TTEM made an all-out effort to market to those industries which would have large projects. By the end of the second year, TTEM had approved four subprojects, which was one more than envisioned in the Project Paper for the first year of the project.

The marketing emphasis demanded of TTEM often affected the staff's capabilities to perform some of its other functions, such as evaluation of the subprojects and providing technical assistance to energy users. An improved system of marketing could be a system of identification and marketing by technology. In order to reach the small energy user, a much longer and more intensive marketing effort would have had to take place.

Promotional activities through local business groups and the media were marginally effective in generating projects. This type of marketing certainly contributed to energy conservation awareness, but its effectiveness is difficult to measure. Technical seminars and short-term consultant visits were very effective in promoting the technologies, although again, there is no concrete measure of this. The number of technical seminars held during the four years fell short of the number specified in the Project Paper (80), primarily due to time and budget constraints. However, the TTEM seminars tended to have higher attendance than those envisioned in the Project Paper, and considerable activity took place in the area of in-plant assistance. It is questionable whether the industrial sector could have absorbed and benefitted from such a large number of seminars. Additional promotional activities using local consultants and/or advertising agencies could have been expanded if time and budget would have permitted.

Another factor in marketing which was not recognized early enough in the project was the importance of interaction with the right decisionmakers within the firm. Too often the TTEM marketing session was set up with a more mid-level person in the firm who was unable to commit the firm to investment in energy conservation. Typically, he or she was technically competent to discuss energy conservation objectives, but lacked seniority to commit company resources to a project.

Some marketing did occur through PFIs and vendors/suppliers, however this proved to be more difficult than was envisioned in the project's design. The PFIs are considered to have been effective in the limited amount of marketing which they undertook. It is likely that the

fund amount and potential business generated from the DLF were not enough incentive for the PFIs to market aggressively. Local consultants and vendors were not effectively accessed by TTEM, and therefore did not participate in marketing. This may be one of the largest shortcomings of project implementation. In the U.S., engineering design consultants play a big role in recommending sources of funding to their clients. The TTEM project did not set up an adequate system or provide incentives to consulting firms in the private sector to participate in the program.

4.2.5 Performance Monitoring

Due to the relatively short time span of the project, TTEM was unable to monitor the performance of all of the subprojects. A credible measure of results is required to encourage replication of energy conservation projects. Four years is insufficient time for project implementation and to allow for a reasonable monitoring period of a year or two. In the case of TTEM, while the staff are attempting to complete six case studies of projects prior to the PACD, not enough time will be available to widely disseminate the results of the subprojects. In addition, a standard computer-based monitoring program should have been developed or purchased which could be supplied to client firms.

4.2.6 Training and Institutional Development

A systematic overall evaluation of the training program was not conducted as part of TTEM, although it was recommended in the Institutionalization Study that such an evaluation take place. The TTEM staff indicated during the study that the pressure at the beginning of the project to develop and obtain subproject approvals, together with the limited number of locally available training programs, resulted in lower priority towards staff development than was anticipated in the project design. Training of TTEM/OEA staff occurred at a much later stage in the project than originally anticipated, particularly the U.S. training programs. Thus the benefits gained through training did not have an early impact on the activities of the staff and the quality of the subproject evaluations. Unless the staff are retained after the PACD, the effects of the training will not be fully realized and will potentially be lost.

Evaluation of the U.S. training programs was done as part of the trip wrap-up and documentation. Each aspect of the program was examined to determine its benefit to the participant and to TTEM, and to improve on the proceeding training program. An evaluation summary is contained in each of the training trip reports. The individuals tended to benefit greatly from the training, however as indicated earlier, the training probably took place too late in the project to be more than marginally useful to the project as a whole.

One criticism of the U.S. training program is that trainees were selected by OEA more on the basis of seniority and process of elimination than by a training needs assessment. Generally, RMA proposed a training program for a specific TTEM technology. The purpose was to train TTEM and OEA staff in all of the applicable TTEM technologies so that they could apply this knowledge to TTEM projects. The OEA Training Committee

then selected trainees to attend the program. If the trainees had been identified first, particularly in the case of TTEM staff, the training could have been more specifically tailored to their background and needs. A more organized and targeted training program could have blended the marketing and technical evaluation needs.

The in-country technical education seminar programs were evaluated by the participants following each program. General feedback indicated that the programs were well-organized, thorough and provided participants with a good overview of the subject matter. For the TTEM project, each seminar offered the opportunity to market the DLF and to make contacts which were followed up at a later date with marketing calls and technical assistance.

4.2.7 Technical Assistance

The technical assistance provided by TTEM staff generally went quite well. TTEM has demonstrated competence in conducting energy audits, assessing feasibility studies, evaluating the technology applications and providing technical extension services. In fact, time and resources limited the staff from providing the level of technical assistance requested by the industrial and commercial community. There exists a great need in the industrial and commercial sectors for technical assistance. Given greater resources, TTEM could have marketed their technical assistance function more, which may have had a greater impact on replication and on moving private firms into energy conservation projects and technologies. TTEM tended to concentrate its efforts on those firms which would avail of the DLF.

Most likely the weakest aspect of the project was its inability to access the private sector through local subcontracts with technical firms. This would have served two purposes: 1) to take advantage of local talent, and 2) to promote the growth of this type of technical assistance in the service sector. TTEM was unable to set up the contracts for a number of reasons: 1) the administrative burden imposed by the requirements of complying with both OEA and USAID procurement regulations; 2) the requirement that both OEA and USAID approve the contracting process and the contracts themselves; 3) the contracting process was started too late in the project; and 4) the relatively small amount of work which would have resulted from the contracts due to the small budget available for contracting and the small size of projects. Because of these complications, the contracting never really got off the ground in the project. When RFPs were finally issued in the last year of the project, the response from the private sector was very limited.

The technical library was marginally effective. The periodicals and reference books were useful, however the manufacturer's information was less so. A useful addition to the TTEM library would have been a short do-it yourself course and reference materials on technology subjects from vendors and professional associations (ASME, AICHE, etc.). This would have provided the staff with useful examples to work from. Catalogs containing these types of materials were forwarded to TTEM for review, however TTEM staff needed more guidance

in using these catalogs. Since the technical library was marginally effective, it would have better to procure and install an IHS microfilm system of vendor catalogs and standards. More training on engineering and financial software programs would also have been useful.

The Resident Advisor technical assistance role was crucial to the project's success. He provided training and technical expertise to TTEM staff and to DLF clients. However, his efforts were hampered by the administrative and coordinative tasks which took away time which could have been better spent on technical assistance. The Resident Advisor should have had a technical/administrative assistance from the beginning of the project. This would have allowed for the Resident Advisor to spend more time training the TTEM junior staff in technical areas, thus preparing them to take over the project when it is assumed by OEA. This idea was proposed by RMA at the start of the project, but was rejected by USAID. In retrospect, RMA should have reevaluated the need for this assistance and proposed it again.

Finally, the short-term consultants were, for the most part, effective in fulfilling their roles as trainers and providing technical assistance to firms. Trip objectives were most often met when they were formulated jointly by TTEM staff and the technical assistance contractor. TTEM staff and the RMA Resident Advisor should have done more preparation prior to their arrival to make the visits more effective.

4.2.8 Commodity Procurement

The commodities procured were generally appropriate to the project, and were of vital assistance in providing marketing, technical assistance and project management. Particularly important to meeting project objectives were the audit equipment, the computer equipment and the project vehicle. Some of the audit equipment was not well-utilized by the staff because of its advanced technical nature (in particular the Controlotron ultrasonic flowmeter and the Solomat HVAC tester). It is recommended that the OEA staff take the time to learn the use of these instruments.

The project vehicle was invaluable to the staff for site visits and marketing calls. The project could have benefitted from another vehicle, as much staff time was lost due to transportation unavailability. It also would have served the project better if a locally available model vehicle were purchased, rather than an imported one, since spare parts would have been more readily available. RMA suggested procuring a vehicle locally, but this was rejected by OEA.

The computer hardware which was purchased was generally appropriate, however a few expansion features should have been considered, such as a math coprocessor. Laptop computers should have been procured for on-going monitoring. They would have been more effective than having to collect data after project construction. The software which was purchased was limited and most of it was outdated by the end of the project. A more concentrated effort should have been made at the beginning of the project to establish a

sound base of appropriate software tools. Some of the software programs, particularly monitoring and performance evaluation, could have been offered to clients as a part of technical assistance. Selection of the software should be at the appropriate level of difficulty so that staff and clients can easily by trained on it and so that it can be maintained after the Resident Advisor leaves.

4.2.9 Energy Conservation Policy Development

A number of policy studies were undertaken by TTEM later in the project, mostly because of the late start of the project and the intensive time and resources needed to develop demonstration projects required. In addition, policy study expectations were never clearly defined by USAID or OEA, thus they received low priority. However, the policy issues addressed by TTEM were timely, and show potential for being highly effective. For example, the BOI exclusion for energy conservation equipment was utilized by six of the DLF clients, and potentially other firms.

Both the institutionalization study and energy policy study could significantly impact long-term GOP energy conservation policy. An institutionalized TTEM program, with additional capital for the DLF, shows great potential for replication of the savings realized in the twenty DLF subprojects. The energy policy study has been well-received by USAID and OEA, and has been distributed to a number of other GOP departments for review. This should lead to discussion amongst the parties on effective strategies for dealing with long-term energy futures for the Philippines, and if the proposed Energy Conservation Bill is passed, some of the suggested policy measures will go into effect.

4.2.10 PLDT Cogeneration Study

The PLDT cogeneration study met all of the objectives defined for Phases I, II, and III and has been well received by all parties. A cogeneration system design and procurement specification were completed for a package cogeneration system to meet the energy requirements of 35 tons of air conditioning and 100 KW electricity for a smaller central office. This package has the potential for replication in over 85 PLDT smaller central offices. Similar specifications were prepared for a system to meet requirements for a larger central office of 100 tons of air conditioning and 300 KW of electricity. This system has the potential for replication in 55 PLDT large central offices.

A final presentation to PLDT's upper management yielded very positive reception to the utilization of the cogeneration systems to improve telecommunications reliability in a situation of decreasing public sector power reliability. Increasing concern for reliability has offset the decreasing economic benefit of some of the cogeneration projects caused by the depreciation of the peso against the dollar. PLDT is moving on a procurement plan that will release the specification for bid in March 1991, pending formal approval by the PLDT upper management.

Continued USAID/PLDT jointly funded technical support in the procurement process will help ensure the demonstration of reliability and economic viability of the cogeneration systems. In addition, USAID support of additional feasibility studies and an overall cogeneration market assessment of the potential power generation capacity would be recommended. Study results could provide OEA the background necessary to sustain the current exemption on import taxes and duties for cogeneration systems, justify additional incentives such as capacity tax credits, and give impetus for greater development of private power purchase contracts with utilities. These measures would truly make cogeneration systems economically viable and help develop the power generation capacity that the Philippines so desperately needs.

5.0 INSTITUTIONALIZATION OF TTEM

At the request of OEA and USAID, RMA conducted a study in the first quarter of 1990 on institutionalization of the TTEM project. The study had as its primary objective to recommend an effective structure for continuing the work of TTEM following the withdrawal of official USAID assistance. A broader goal of the study was not only to continue the TTEM program, but to expand and improve the implementation of energy efficiency measures throughout the country. The study provided an overall assessment of TTEM; examined the potential and environment for energy conservation in the Philippines; presented alternatives for institutionalizing the project; and made recommendations for both the short and long-term futures for the TTEM project and for institutionalizing energy conservation in the Philippines. This section will summarize the results of the study; present the institutionalization plan which was adopted by USAID, OEA and the TTEM Steering Committee; and discuss the status of implementation of the institutionalization plan.

5.1 Institutionalization Study and Recommendations

The study recommended both an immediate and an expanded option for TTEM. The expanded option is predicated on locating additional funding for energy conservation projects. A larger loan fund would provide greater incentives to the private sector to generate investment in energy conservation. Both of the options will be described briefly below; full details are available in the final report of the institutionalization study (RMA 1990).

5.1.1 Recommended Immediate Institutionalization Option

Financial Attributes

A specific revolving trust at the Development Bank of the Philippines (DBP) would be created by transferring the funds from the Central Bank as directed by Executive Order. The fund would be started by transferring all existing and future TTEM DLF reflows into this revolving fund. The principal would be dedicated to financing energy conservation subprojects, while earmarked portions of the interest earned on the trust account would be available for:

- administration of the revolving fund by DBP;
- continuation of an OEA (TTEM) staff;
- a limited sharing/matching grant pool for use of the private sector to carry out audits and technical feasibility and designs of subprojects;
- a limited number of education seminars for staff and/or interested parties.

The remainder of the annual interest earnings would be retained in the revolving fund for fund growth.

Technical Attributes

OEA, with continued guidance of the TTEM Steering Committee and the Subproject Selection Committee, would provide the primary coordination and management, retain control over specific subprojects to be funded, and oversee the allocation of resources within OEA. The technical functions of the project would be distributed among the following institutions:

- Engineering firms and/or private sector consultants, through a cost-sharing grant pool for the private sector and direct payment by firms interested in implementing subprojects, would carry out various technical tasks, including energy audits, feasibility, and preliminary design studies.

- OEA (TTEM) staff, explicitly identified and situated within the Conservation Division, would carry out the detailed monitoring and evaluation of subprojects already financed by TTEM, as well as other TTEM functions.

- Organizations such as the University of the Philippines, National Engineering Center, and the Energy Managers Association of the Philippines would carry out energy conservation education and training programs.

The portion of the fund interest provided to OEA would be used within the Conservation Division, earmarked specifically for the above purposes.

5.1.2 Institutionalization of an Expanded Project

The expanded institutionalization option depends upon additional funds being added to the DLF, since the immediate option is handicapped by the size of the DLF. Funding constraints limit the ability of the TTEM Project to provide incentives to the Philippine private sector to generate investment in energy conservation. A larger loan fund would allow for a higher limit on the size of the loan, and expand the grant pool available for energy audits and feasibility studies. The basic organizational structure proposed for the immediate option could be maintained, along with the specific functional makeup of TTEM. Because of the unchanging structure and functional makeup, the transition from the immediate to the expanded option would assume a gradual progression rather than a discrete jump as more staff personnel were hired to serve the larger project.

The expanded option incorporates 1) a substantial supplement to the loan fund, to be managed as a revolving fund by DBP; 2) movement of most of the technical assistance functions to the private sector; and 3) retention of OEA as the lead agency, primarily for project management and coordination.

OEA was recommended as the lead agency because it is the public agency with prime responsibility for energy conservation. OEA has accumulated substantial expertise and experience in energy conservation technology transfer. OEA has a critical role to play in generating and disseminating information on the production, consumption, costs and prices of various sources of energy and on technologies for its efficient use.

An increased role for the private sector was recommended, particularly in the area of technical assistance where the profit incentive can operate effectively. Routine engineering design and energy evaluations are activities that the private sector could readily assume, given the incentive to do so. Specific mechanisms, such as cost sharing/matching grants, were recommended to encourage the participation of the private sector.

5.2 Institutionalization Plan

The results and recommendations of the Institutionalization Study were presented to the TTEM Steering Committee and to USAID in May 1990. The Steering Committee adopted the report recommendations, and TTEM Staff began to put together an institutionalization plan. The plan has the following major characteristics:

* Establishment of a trust fund with the DBP for the DLF reflows;
* Continuation of a TTEM staff within the OEA Conservation Division;
* Establishment of an operating budget for TTEM within OEA;
* Continuation of project monitoring and information dissemination activities by TTEM staff;
* Development of an overall plan of TTEM activities;
* Seek additional donor funding to expand the DLF;
* Increase private sector involvement.

5.3 Status of Institutionalization

OEA has pursued the institutionalization of the TTEM Project through two major action programs, as recommended in the study.

<u>Continuation of TTEM under OEA's Conservation Division</u>

To achieve this program, OEA began the process by requesting an opinion from the Department of Budget Management (DBM) on the best option to retain the DLF as a revolving trust fund for energy conservation after the PACD. DBM, in reply, recommended

that OEA include the TTEM Project, particularly the DLF, in its 1991 budget request. TTEM has been included in the proposed 1991 General Appropriations Bill for the government budget, which the House of Representatives is currently reviewing.

To complement this move, OEA has proposed to the Congressional Committee on Energy the inclusion of the TTEM project in the proposed Energy Conservation Law. A section in the proposed law gives the mandate to OEA to continue with the activities of TTEM, most importantly the administration of the DLF.

Additional Funding for the DLF and Support for TTEM Activities

The expanded option suggested in the study is being pursued by OEA in parallel with the immediate option. Letters of interest for fund sourcing were sent to the World Bank, Asian Development Bank (ADB), and OECF of Japan. Negotiations with World Bank representatives during the second quarter of 1990 have led to the inclusion of energy conservation in the proposed industrial restructuring facility of $250 million. The World Bank is also working on a possible $1.0 million technical assistance grant for the TTEM Project.

OECF and ADB have referred TTEM to the Philippine National Economic and Development Authority (NEDA), as these agencies process funding requests based on NEDA recommendations. OEA has completed a project proposal for TTEM which was submitted to NEDA for inclusion in the USAID-funded Philippine Assistance Program (PAP). The project proposal envisions $25 million additional funding for the DLF and a $2.5 million technical assistance component for TTEM.

6.0 LESSONS LEARNED DURING PROJECT IMPLEMENTATION

6.1 The TTEM Project

Despite severe electricity shortages and cutbacks on oil importation, energy conservation has taken a lower priority than the development of energy resources, power infrastructure, and the general industrial base in the Philippines. TTEM has marginally changed this emphasis and it is likely that the institutionalized program will have only a modest future impact, unless its fund is greatly expanded. Energy conservation programs are often the first type of program to be eliminated when budgets are tight and immediate incentives for conservation no longer exist (i.e. high energy prices). Although energy prices have increased significantly over the past few months, this may be perceived as a temporary situation. In addition, the Philippines still faces a capital shortage, where many industrial restructuring and infrastructure projects are competing for funds with energy conservation investment.

The above factors present special challenges to the institutionalized TTEM program. The tremendous need and potential for energy conservation still exist, as documented in the institutionalization study. Based on the experience of the past four years, we believe that efforts of the institutionalized TTEM program should be concentrated on the following:

1. Additional donor country and multilateral loan funds to support TTEM activities, particularly the areas of technical assistance, local technical development, outreach and energy policy development. Undoubtedly, the ability of the TTEM program to encourage energy conservation investment is limited by the size of the fund. If more funding were available, on the order of $50 - $100 million, the loan limit could be substantially raised which would make the fund more attractive to large-scale projects, and achieve much higher levels of energy conservation.

2. Continued use of the DLF to provide concessionary loans for financing demonstration projects. Providing access to capital through commercial banks has proven to be an effective mechanism for funding energy conservation projects. Awareness of the economic viability of energy conservation projects should be expanded throughout the financial sector.

3. Continued outreach which emphasizes the cost-savings realized through energy conservation investment. The DLF is a vehicle for energy conservation promotion, however the cost-saving benefits are a much more effective selling point for encouraging investment.

4. Expanded technical assistance and information dissemination, and evaluation of its effectiveness. Information dissemination activities should focus on the completed subprojects with successful case studies being marketed to similar industries. Performance monitoring should be vigorously pursued. A system

should be set up to follow up on firms provided with technical assistance to determine whether energy conservation investment was made as a result of TTEM, and to identify whether replication of subprojects is taking place.

5. Greater reliance on the private sector for technical assistance, auditing and marketing functions. The institutionalization study recommended the establishment of a cost-sharing grant mechanism to provide incentive to the private sector to participate in energy conservation. It is crucial to involve vendors and engineering consulting firms to establish widespread participation, and to build on local technical capabilities.

TTEM takes place in a larger energy policy and institutional setting. The energy policy study recommended a series of institutional and policy changes, which were given in Section 3.2.9.

Since the GOP has already taken some steps toward implementing a number of the policies, more research and development in this area could bring long-term and effective policies to implementation. A coordinated effort between OEA, other government agencies, and TTEM, with possible support from USAID, is needed in this area.

6.2 USAID Energy Conservation Projects

Several broader "lessons" have also been learned in the course of project implementation which may be applicable to future USAID project development in energy conservation, in both the Philippines and in other developing countries. These lessons are summarized in the points below.

1. Project Term - Energy programs like TTEM require substantial start-up time to hire a competent staff and to become fully operational. Marketing the DLF and energy conservation also required a sustained effort over the entire project term, thus utilizing a large portion of the staff's time. One of the USAID Audit report's major criticisms was that no replication had taken place. In some cases, implementation of technologies, such as those funded by TTEM, requires up to three years for completion. Therefore, even if the project had gone the full five year term, it is unlikely that much replication would have been evident. For future programs of this type, it is recommended that the minimum project term be seven years, if widespread replication is to be seen.

2. USAID Commitment - Commitment from USAID throughout the life of a project is elementary to project management, planning and project staff morale. In the case of TTEM, the project got off to a late start, and as a result was constantly under the threat of being deobligated. The direction from USAID was not clear and consistent. This created a demoralizing

atmosphere for many of the staff members. A more positive and consistent approach on the part of USAID would have greatly facilitated project planning and management.

3. USAID Direction - USAID should provide and uphold a consistent set of priorities and direction for a project. In the TTEM experience, USAID provided limited direction for the project. The Project Officer changed several times, and each time the emphasis of the project changed. A consistent set of priorities and work plan would have aided in diminishing the impact of personnel changeover.

4. Project Funding - A higher level of funding is recommended for future projects similar to TTEM. The DLF of $2.43 million was inadequate to implement more than 20 subprojects in the four-year period. Given five to seven project years, it is likely that a loan fund twice the size of the DLF could have been disbursed. If the loan ceiling of $200,000 were eliminated, the project could have been many times larger.

5. Initial Project Phase - The initial phase of a project similar to TTEM should be spent primarily on compiling information on local technical expertise available and markets for energy conservation technologies. In the case of TTEM, more work should have been done at the start of the project to set up a baseline of the status of energy conservation technologies and potential clients in the Philippines. This could have included the identification of local vendors and technical consultants to participate in the program. The all-out effort to develop demonstration projects inhibited resources from being allocated for this activity.

6. Location of the Project Staff - Careful selection of the institutional location of a project and its relationship to the institution is very important for effective project implementation. To ensure committed management of a project it should be located in a well-established organization which has the same goals as the project. The TTEM project would have benefitted from closer cooperation between TTEM and OEA staff. This may have been facilitated if the project were staffed with existing government staff. Because TTEM staff received higher wages than OEA staff, it may have been more effective if it had been located higher up within the Conservation Division.

In conclusion, the most important issues in the potential success or failure of a project like TTEM are comprehensive planning, evaluation and especially commitment. Energy conservation projects take time to implement. Long-term vision and commitment are prerequisites to the success of implementing energy conservation initiatives.

7.0 RECOMMENDATIONS FOR FUTURE PROJECT DEVELOPMENT

Key Factors

The TTEM Project has demonstrated three key factors with respect to future project development:

1. The market exists for energy conservation projects - The large interest generated within the industrial and commercial sectors by a relatively small loan fund, together with the energy savings and financial return of the TTEM DLF subprojects, have proven this.

2. Energy conservation projects can be implemented - TTEM has shown that the private sector will take a "perceived risk" on energy conservation projects if sufficient technical and financial support is provided.

3. A self-sustaining TTEM program at an appropriately large scale has not yet been achieved - Increased financial and continued technical support to the GOP will be necessary to utilize the momentum initiated by TTEM.

OEA will be continuing the goals and objectives of TTEM under an institutionalized program. However, given the small size of the DLF fund and the limited technical resources of OEA, it will not be possible to sustain the existing level of support. Much of the gains in energy conservation promotion are at risk of being lost.

USAID Assistance Components

It is recommended that USAID provide follow-up technical and financial assistance to TTEM to ensure the growth of the program to a size that will have a major impact within the Philippine economy. Follow-up TTEM project funding would be constructed much differently than the original. Rather than providing complete start-up support, USAID's assistance would be channeled only to those areas where OEA is still weak. In particular:

1. OEA would assume a more proactive role in management and administrative areas.

2. USAID support would be channelled primarily to providing specific technical expertise, and in infusing the DLF fund with additional capital for more and larger energy efficiency projects.

3. USAID support should be provided for specific actions on the part of the GOP to promote energy conservation, primarily through development and implementation of definitive GOP policy.

Program Development

In order to accomplish these actions, USAID would need to develop a specific Project Assistance Paper. RMA would recommend that the following essential elements be included in the paper:

1. Assess the Market Potential - There have been a number of studies on the potential market for energy conservation in the Philippines over the past few years, particularly the studies funded by USAID, the World Bank and ADB. The results of these studies could be compiled and expanded. This would give a more accurate accounting of the investment required to achieve the energy conservation potential. A realistic plan for marketing the DLF could be drawn from these studies as well. Based on this plan, a schedule of USAID contributions to the DLF could be developed.

2. Technical Assistance - Although there are competent staff within OEA, continuing technical assistance and training is necessary to sustain the momentum established by TTEM. The Project Assistance Paper would identify and make recommendations for providing specific technical assistance to OEA.

3. Outreach Activities - Information dissemination and promotional seminars will play an ever increasing role if OEA is to adopt a more proactive stance on promoting energy conservation, in particular encouraging private sector participation. There are many areas where USAID could assist in this area, especially through funding the use of local expertise.

4. Philippines Technical Development - There is a great opportunity to build on and develop technical resources among the Philippine technical community. The Project Assistance Paper could address specific measures to increase the technical capability of the country's own resources, thus lessening the dependence on foreign consultants. These should include training and utilizing local technical expertise for all aspects of subproject implementation.

5. Policy Development - The Project Assistance Paper should address an expanded in-country study on energy conservation policy development which involves key Philippine policy-makers and institutions. This should assist in the formulation of a plan to coordinate policy and technical assistance programs. Continuing USAID assistance may encourage the adoption of specific energy policy.

It is estimated that the development of the Project Assistance Paper would take 3-4 months, and could be initiated at any time.

Summary

RMA recommends that USAID proceed with the development of the Project Assistance Paper. As the development of the Project Assistance Paper proceeds, many of the general areas discussed above will become more definitive.

USAID support of the original TTEM program has provided the GOP with a major boost toward sustaining a long term program of efficient utilization of energy resources. The GOP is preparing to continue with this program as best they can with limited resources. RMA believes that continued support of the TTEM program will give the GOP the final impetus to develop a sound long term program of energy conservation on a scale that will have a significant impact on the Philippine economy and environment.

APPENDIX A
RESOURCE DOCUMENTS REVIEWED

APPENDIX A: RESOURCE DOCUMENTS REVIEWED

Hanson, Mark E. and Diane Hennessey, "Energy Conservation Policy for the Industrial Sector: Do Demonstration Projects Work?". Conference Paper. Proceedings of the 25th Intersociety Energy Conversion Engineering Conference, August 12-17, 1990.

Louis Berger International, Inc., and Checchi and Company Consulting, Inc., Technology Transfer for Energy Management Project Evaluation prepared for USAID Mission, Manila, Philippines, January 1989.

Office of Energy Affairs, The Philippine Medium-Term Energy Plan 1988-1992, 1989.

RCG/Hagler Bailly, Inc., "Power Sector Cost Structure and Transfer Pricing Study", prepared for Asian Development Bank and the Office of Energy Affairs, January, 1990.

Resource Management Associates of Madison, Inc., Monthly Reports to USAID/Philippines and OEA, MR-1 through MR-45. March 1987 through October 1990.

Resource Management Associates of Madison, Inc., Consultant Trip Reports. RMA/GOP-TD-1 through RMA/GOP-TD-13. June 1987 to August 1990.

Resource Management Associates of Madison, Inc., Technology Transfer for Energy Management Annual Reports. RMA/GOP-AR-1 through RMA/GOP-AR-3. 1987-1989.

Resource Management Associates of Madison, Inc., "Energy Conservation Policy Option for the Philippines", November 1, 1990.

Resource Management Associates of Madison, Inc., "Study of the Options for Institutionalization of the Technology Transfer for Energy Management Project in the Philippines", Final Report. Prepared for USAID, Philippines. April 30, 1990.

Technology Transfer for Energy Management Project. Project and Sub-Project Technical Data. 1988 - 1990.

USAID, Technology Transfer for Energy Management Project Paper and Annexes, 1985.

USAID, "Private Power Reporter: A Summary of Private Power Activities in Developing Countries", prepared by Office of Energy, U.S. Agency for International Development, July 1990.

USAID, "Audit of USAID/Philippines' Technology Transfer for Energy Management Project No. 492-0381", Audit Report No. 2-492-90-09, August 24, 1990.

APPENDIX B
EXCERPTS FROM USAID PROJECT PAPER

AID 1020-25 (1-78)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1988 to FY 1992
Total U.S. Funding 10,000,000
Date Prepared: April 21, 1986

Project Title & Number: Technology Transfer for Energy Management (497-0281)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1) To increase the productivity of energy use in the modern sector, and reduce dependence on imported oil.	Measures of Goal Achievement: (A-2) 1. Reduction of modern sector energy consumption per unit of output (physical or service). 2. Less oil imported for modern sector use.	(A-3) 1. Interviews with modern sector owners/ managers, review of fuel purchasing records, and analysis of monitoring data and evaluation reports from demonstration sites. 2. Review of Ministry of Energy import records. 3. Interviews with users associations, BEU records and Ministry of Industry records.	Assumptions for achieving goal targets (A-4) 1. That energy conservation through adoption of new technologies can contribute to an effective energy demand management program. 2. That GOP is prepared to make additional policy change as identified, to support sector goals.
Project Purpose: (B-1) Higher Level Purpose The primary purpose of this project is to promote and accelerate the adoption of energy efficient technologies (equipment processes and management systems) by the modern sector. Lower Level Purpose a. Improved institutional capabilities of BEU and private sector groups to implement energy conservation initiatives. b. Improved private sector understanding of energy conservation potential and greater awareness of available options	Conditions that will indicate purpose has been achieved: End-of-Project status: (B-2) 1. Increased number of industrial, commercial and building owners/managers adopting new technologies. 2. Increased volume of private sector requests for analytical and technical assistance from local institutes and local and U.S. consultants. 3. Increased private sector energy conservation promotion activities. 4. Increased number of loan applications processed for equipment purchase and requests for energy tax returns. 5. More local consulting groups formed to provide energy conservation services.	(B-3) 1. Review individual and association records, as well as BEU surveys. 2. Survey of banks and Bureau of Internal Revenue records. 3. Survey of private sector in-house and association promotion programs. 4. BEU records and survey of end-users and consulting groups.	Assumptions for achieving purpose: (B-4) 1. That modern sector consumers are interested in reducing energy consumption. 2. That new energy efficient equipment, processes and management systems can increase productivity. 3. That consumers can realize economic and financial advantage from new technologies and can be encouraged to act. 4. That BEU and private consultants, can develop capabilities to respond to increased demand, and in fact stimulate demand. 5. That private groups want to and are encouraged by the GOP to play a major role in the project.
Project Outputs: (C-1) 1. Energy efficiency of new technologies and management systems demonstrated. 2. Awareness and understanding of energy conservation options increased through seminars and workshops. 3. On-the-job training and study missions completed. 4. Increased awareness of future role of technologies and management systems achieved through studies. 5. Increased number of better trained plant engineers/ technicians through seminars, workshops, training and demonstrations. 6. Innovative financing mechanisms for energy conservation introduced in private sector banks. 7. Stimulation of additional funding from private financial institutions and international donors.	Magnitude of outputs (C-2) 1. Demonstrations completed. 2. Seminars - 1 per demo or study - 80 during LDP. 3. Approximately 70 training sessions and 30-40 study missions. 4. Approximately 70 technology and 10 policy studies. 5. Average workshop/seminar has 20 attendees, plus technicians trained in demos - approximately 1600 LDF. 3. Banks adopting new financial mechanisms. 7. Bankers and donors starting new funding efforts.	(C-3) BEU, USAID and consultants' project assessments and reports, and interim and final evaluations.	Assumptions for achieving outputs: (C-4) Initial support and interest by GOP, energy producer and ultimate energy users.
Project Inputs: (D-1) 1. Technical assistance 2. Commodities for training and energy efficiency measurement and monitoring. 3. Studies to analyze sector or industry specific problems and solutions, or policy development. 4. Seminars and workshops to present new technologies for and approaches to energy conservation. 5. Industry and production specific equipment or management system demonstrations. 6. Evaluation. 7. Operations and maintenance.	Implementation Target (Type and Quantity): (D-2) ($000) USAID Funding: 5,000 GOP Funding: 2,274 1. 1,507 160 2. 100 3 3. 154 67 4. 494 200 5. 2,660 1,352 6. 75 – 7. – 492	(D-3) Project records and reports.	Assumptions for providing inputs: (D-4)

Table G4
Summary TTEM Demonstration Costs ($000)

Technology	Number of Demonstrations	Total Capital Investment 1/	Net Capital Investment from TTEM Project 2/	Monitoring and Information Dissemination cost 3/	Total TTEM Obligation
Combustion monitoring and control system	6 4/	19.2	14.4	130.0	144.4
Flue gas heat recovery systems	4	221.2	165.9	86.9	251.9
Increased use of insulation in industrial processes	4	1.4	1.1	74.0	75.1
Power factor control equipment	4	292.1	219.0	17.0	219.1
Steam distribution system maintenance procedures	4	7.0	5.2	66.0	71.2
Outside air temperature compensation for chiller systems	4	17.1	12.9	45.0	57.9
Building energy management systems	8	156.6	117.4	16.6	134.0
Increasing roof insulation in existing buildings	4	20.0	15.0	45.0	60.0

1/ Capital investment in dollars and pesos for 1 project times the number of projects.
2/ Loans and grants, assumed to be 75% of total capital investment.
3/ Loans, grants and administrative, monitoring, and information dissemination costs.
4/ Three large and three small installations.

TTEM Project Paper, Annex G, pg. 12

Table H1
Potential TTEM Demonstration Projects

	Capital Investment (Single Installation)			Annual Operation and Maintenance			Annual Energy Savings		Annual Savings		
	Equipment	Installation	Total 1/	Manpower	Supplies	Total 1/	KLOE	mmBtu or Kwh	Value (₱) 2/	Net Savings 3/	Payback 4/
A. Industrial equipment											
Combustion monitoring and control system											
Small	$340	-	₱6,290	₱22,500	₱1,850	₱24,350	68	2,500 mmBtu	₱230,000	₱205,650	11.2 days
Large	$,100	460	95,310	22,500	$1,000	41,000	337	12,500 mmBtu	1,150,000	1,109,000	31.4 days
Flue gas heat recovery systems	51,000	60,000	1,003,500	3,000	-	3,000	68	2,484 mmBtu	228,528	225,528	4.4 years
Increased use of insulation in industrial processes	₱4,000	1,000	5,000	-	-	-	12	460 mmBtu	42,320	42,320	1.5 months
Power factor control equipment	$ 72,250	10,000	1,346,625	2,400	-	2,400	-	192,600*	2,037,800	2,035,400	8 months
Steam distribution system maintenance procedures	1,700	600 + 10,000	42,050	-	-	-	-	11,030 mmBtu	1,014,760	1,014,760	15 days
B. Building system maintenance procedures											
Outside air temperature compensation for chiller systems	12,000	60,000	282,000	3,000	-	3,000	-	53,000 Kwh	37,950	34,950	8.1 years
Building energy management systems	17,000	36,000	350,500	4,800	-	4,800	-	189,300 Kwh	217,695	212,895	1.6 years
Increasing roof insulation in existing buildings	115,200	5,000	120,000	-	-	-	-	14,500 Kwh	16,675	16,675	7.2 years

TTEM Project Paper, Annex H, pg. 2

Table 15
Estimated Project Expenditures by Type of Project Specific Inputs
($000s)

	SOURCES OF FUNDS				
	AID			Private	
	Grant	Loan	GOP	Sector 1/	Total
1. Technical assistance	1,289	218	160	-	1,667
2. Studies/Workshops/ information dissemination	586	72	77	190	925
3. Demonstration	-	2,660	-	1,352 1/	4,012
4. Commodities/monitoring instruments	50	50	3	-	103
5. Project operations/ management	-	-	492	-	492
6. Project evaluation	75	-	-	-	75
Total 2/	2,000	3,000	732	1,542	7,274

1/ Assuming a 25% financial contribution (on the average) by users for each subproject and $37,838 annual contribution to studies, training and information dissemination.

2/ A 10% contingency factor has been built into each line item.

TTEM Project Paper, pg. 69

52

APPENDIX C
PARTICIPATING FINANCIAL INSTITUTIONS

APPENDIX C: PARTICIPATING FINANCIAL INSTITUTIONS

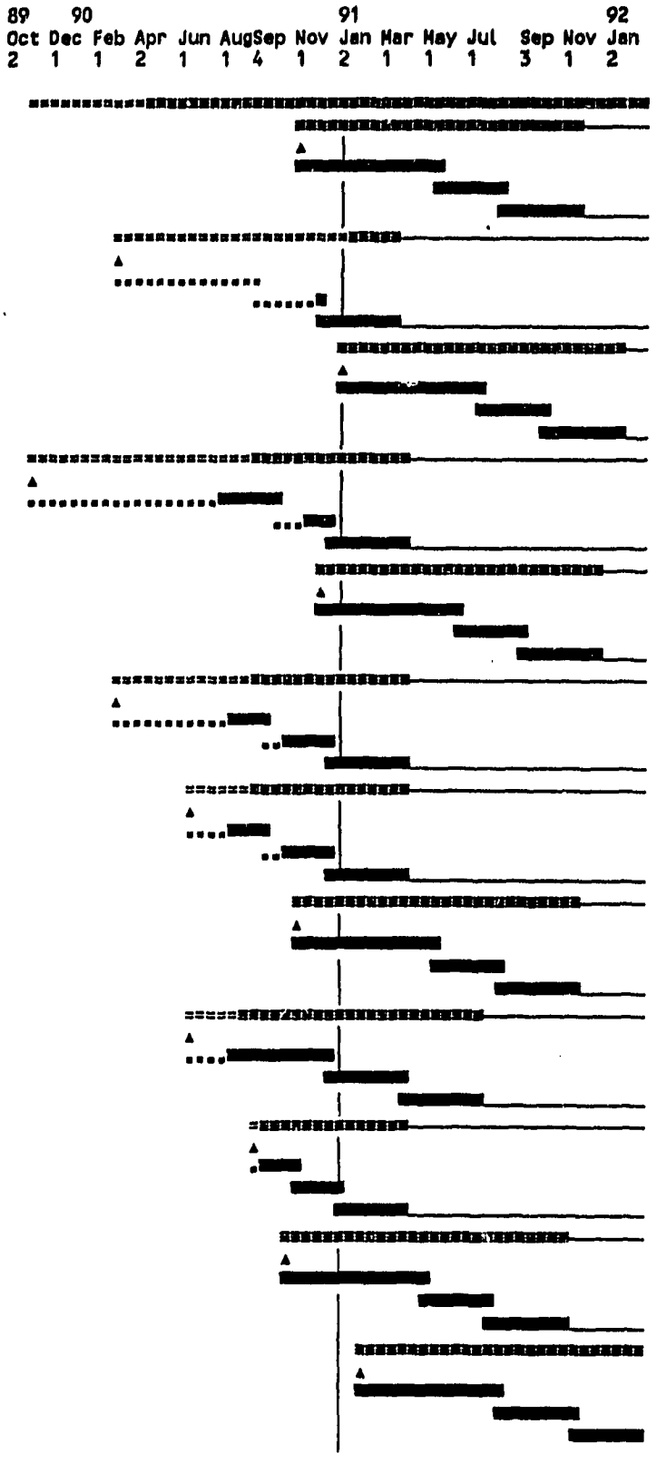
1. Rizal Commercial Banking Corporation
2. Security Bank & Trust Company
3. Solidbank Corporation
4. Private Development Corporation of the Philippines
5. Planters Development Bank
6. Asiatrust Development Bank
7. All Asia Capital & Leasing Corporation
8. Citytrust Banking Corporation
9. Philippine Commercial & International Bank

APPENDIX D
DLF SUBPROJECT DESCRIPTIONS

55

TABLE D1: MONITORING AND CASE STUDY PLAN FOR DLF SUBPROJECTS

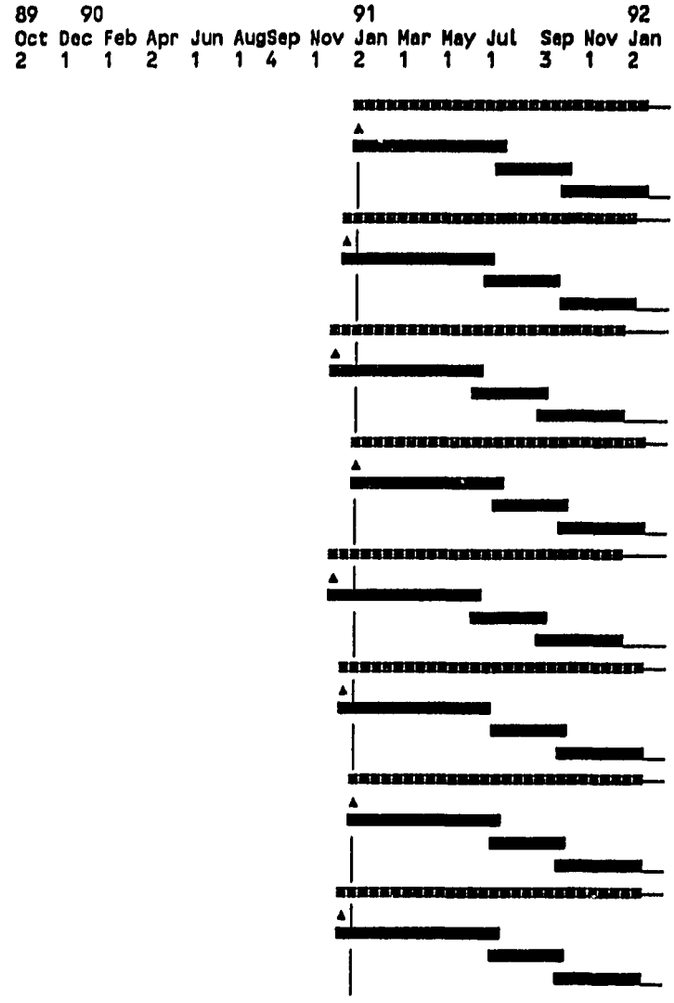
Task Name	Start Date	End Date
DLF PROJ MONITORING	3-Nov-89	19-Feb-92
BENGUET I	31-Oct-90	19-Nov-91
PROJ COMP	31-Oct-90	31-Oct-90
MONITORING	31-Oct-90	13-May-91
CASE STUDY	13-May-91	15-Aug-91
INFO DISSEM	15-Aug-91	19-Nov-91
CADP	1-Mar-90	20-Mar-91
PROJ COMP	1-Mar-90	1-Mar-90
MONITORING	1-Mar-90	6-Sep-90
CASE STUDY	6-Sep-90	12-Dec-90
INFO DISSEM	12-Dec-90	20-Mar-91
PLDT	31-Dec-90	16-Jan-92
PROJ COMP	31-Dec-90	31-Dec-90
MONITORING	31-Dec-90	9-Jul-91
CASE STUDY	10-Jul-91	10-Oct-91
INFO DISSEM	11-Oct-91	16-Jan-92
REP CEMENT	3-Nov-89	28-Mar-91
PROJ COMP	3-Nov-89	3-Nov-89
MONITORING	3-Nov-89	1-Oct-90
CASE STUDY	1-Oct-90	20-Dec-90
INFO DISSEM	20-Dec-90	28-Mar-91
CEPALCO	30-Nov-90	17-Dec-91
PROJ COMP	30-Nov-90	30-Nov-90
MONITORING	30-Nov-90	10-Jun-91
CASE STUDY	11-Jun-91	12-Sep-91
INFO DISSEM	13-Sep-91	17-Dec-91
ARMCO-MARSTEEL	12-Mar-90	29-Mar-91
PROJ COMP	12-Mar-90	12-Mar-90
MONITORING	12-Mar-90	17-Sep-90
CASE STUDY	17-Sep-90	21-Dec-90
INFO DISSEM	21-Dec-90	29-Mar-91
ARAS-ASAN	14-Jun-90	2-Apr-91
PROJ COMP	14-Jun-90	14-Jun-90
MONITORING	18-Jun-90	19-Sep-90
CASE STUDY	20-Sep-90	26-Dec-90
INFO DISSEM	27-Dec-90	2-Apr-91
CENTRAL FERM	31-Oct-90	19-Nov-91
PROJ COMP	31-Oct-90	31-Oct-90
MONITORING	31-Oct-90	13-May-91
CASE STUDY	13-May-91	15-Aug-91
INFO DISSEM	15-Aug-91	19-Nov-91
BENGUET II	15-Jun-90	5-Jul-91
PROJ COMP	15-Jun-90	15-Jun-90
MONITORING	18-Jun-90	26-Dec-90
CASE STUDY	27-Dec-90	2-Apr-91
INFO DISSEM	3-Apr-91	5-Jul-91
RUBBERWORLD	4-Sep-90	4-Apr-91
PROJ COMP	4-Sep-90	4-Sep-90
MONITORING	4-Sep-90	5-Nov-90
CASE STUDY	6-Nov-90	28-Dec-90
INFO DISSEM	28-Dec-90	4-Apr-91
UNION GLASS CC	17-Oct-90	4-Nov-91
PROJ COMP	17-Oct-90	17-Oct-90
MONITORING	17-Oct-90	29-Apr-91
CASE STUDY	29-Apr-91	1-Aug-91
INFO DISSEM	1-Aug-91	4-Nov-91
BELL CARPETS	31-Jan-91	19-Feb-92
PROJ COMP	31-Jan-91	31-Jan-91
MONITORING	1-Feb-91	8-Aug-91
CASE STUDY	9-Aug-91	12-Nov-91
INFO DISSEM	13-Nov-91	19-Feb-92



56

TABLE D1: MONITORING AND CASE STUDY PLAN FOR DLF SUBPROJECTS
Page 2

Task Name	Start Date	End Date
BACNOTAN	31-Dec-90	16-Jan-92
PROJ COMP	31-Dec-90	31-Dec-90
MONITORING	31-Dec-90	9-Jul-91
CASE STUDY	10-Jul-91	10-Oct-91
INFO DISSEM	11-Oct-91	16-Jan-92
ILIGAN L&P	17-Dec-90	3-Jan-92
PROJ COMP	17-Dec-90	17-Dec-90
MONITORING	17-Dec-90	25-Jun-91
CASE STUDY	26-Jun-91	27-Sep-91
INFO DISSEM	30-Sep-91	3-Jan-92
TRUST INTERNATIONAL	30-Nov-90	17-Dec-91
PROJ COMP	30-Nov-90	30-Nov-90
MONITORING	30-Nov-90	10-Jun-91
CASE STUDY	11-Jun-91	12-Sep-91
INFO DISSEM	13-Sep-91	17-Dec-91
ALSONS I	31-Dec-90	16-Jan-92
PROJ COMP	31-Dec-90	31-Dec-90
MONITORING	31-Dec-90	9-Jul-91
CASE STUDY	10-Jul-91	10-Oct-91
INFO DISSEM	11-Oct-91	16-Jan-92
ALSONS II	30-Nov-90	17-Dec-91
PROJ COMP	30-Nov-90	30-Nov-90
MONITORING	30-Nov-90	10-Jun-91
CASE STUDY	11-Jun-91	12-Sep-91
INFO DISSEM	13-Sep-91	17-Dec-91
MABUHAY VINYL	26-Dec-90	13-Jan-92
PROJ COMP	26-Dec-90	26-Dec-90
MONITORING	26-Dec-90	3-Jul-91
CASE STUDY	5-Jul-91	7-Oct-91
INFO DISSEM	8-Oct-91	13-Jan-92
KALINISAN	31-Dec-90	16-Jan-92
PROJ COMP	31-Dec-90	31-Dec-90
MONITORING	31-Dec-90	9-Jul-91
CASE STUDY	10-Jul-91	10-Oct-91
INFO DISSEM	11-Oct-91	16-Jan-92
SUPER PLYWOOD	27-Dec-90	14-Jan-92
PROJ COMP	27-Dec-90	27-Dec-90
MONITORING	27-Dec-90	5-Jul-91
CASE STUDY	8-Jul-91	8-Oct-91
INFO DISSEM	9-Oct-91	14-Jan-92



Detail Task — Summary Task — Milestone
(Started) — (Started) — Conflict
(Slack) — (Slack) — Resource delay

Scale: 2 weeks per character

APPENDIX D: DLF SUBPROJECT DESCRIPTIONS

This Appendix is a description of the 19 DLF subprojects which will be funded by the DLF and one which will be funded by the DLF reflows. Each description gives the 1) background and financial standing of the firm; 2) the description of the technologies implemented; 3) the project status; 4) the DLF project cost and economic assessment (payback period and IRR); 5) expected energy and monetary savings; and 5) an assessment of the national impact of the demonstration. The detailed information on each project presented in this section shows the extensive work done by the TTEM staff over the life of the project. The staff has developed a good system for recording data on each project from the start to the finish. The criteria used to evaluate each project has also been useful as a guideline for consistent recording of necessary data for DLF project approval.

Table D1 represents the TTEM plan for performance monitoring of the projects and the subsequent dissemination of information on each project. More specifically it depicts the completion date or expected completion date of each project; when the project monitoring and case study was completed or is expected to be started; and when the information on each project is expected to be disseminated. The line in the middle of the table indicates the PACD. As shown in the table six case studies will be completed by the PACD.

1./2. BENGUET CORPORATION Projects I and II

Background and Financial Standing

Benguet Corporation is the oldest gold, copper and chromite mining company in the Philippines. Over the years it has diversified into other businesses such as overseas and domestic industrial construction, timber and lime production, trucking, export shipping, handicrafts export, real estate development and agribusiness. Benguet is a public corporation, 60 percent Filipino-owned, 40 percent owned by foreign stockholders.

Benguet is in good economic standing which, at the end of 1988, had a net worth of P1.6 billion. The company is considered by the banking sector to have an excellent credit rating.

Project 1

Description

The first DLF project for Benguet took place at the Dizon Copper mining facility, located in San Marcelino. The operation consists of an open pit mine and a mill which produces copper ore at 19,000 Tons per day. The facility operates 24 hrs/day.

The DLF project entailed installing 75 capacitors in conjunction with the numerous inductive motors in the plant. The capacitors were expected to improve the overall power factor of the plant from 87.8% to 92%.
Status: The project was completed in October 1990 with the installation of the capacitors.

Cost and Economic Assessment

The total project cost is estimated to be P690,000, for which the TTEM DLF contributed 75 percent of the cost (P 520,000) and Benguet funded the remaining cost (P 170,000). The simple payback period was estimated at 1.07 years, assuming consistent savings over the 10 year economic life of the project. The IRR is very favorable at about 95%.

Expected Energy and Monetary Savings

The project is estimated to save 530,080 kwh per year which represents more than a 7.5% reduction in energy losses due to poor power factor. This is equivalent to P536,970 per year (at P1.01/kwh). An additional savings of P106,100 is expected due to a bonus given by National Power Corporation for those clients maintaining a 90% or better power factor. The bonus would reduce energy-related costs of the plant by a total of about P643,100.

National Impact of Project

This project shows that a 7.5 percent savings can be achieved. This is a significant savings which could be achieved in many plants in the Philippines. The TTEM Project Paper identified that approximately 215 firms could implement this technology, or about 75% of the large industrial firms whom were reporting to BEU at that time (1984). This potential is significant in itself and is likely to be much greater. Five of the DLF projects including Benguet have implemented this technology already. If even 25 more plants installed power factor correction equipment, this would achieve almost 12% of the potential estimated in the Project Paper.

Project 2

Description

The second DLF project for Benguet took place at the Paracle Gold Mining Facility, located in Jose Panganiban, Camarines Norte. The facility has a milling rate of 800 metric tons of ore per day. The facility utilizes two 750 cfm diesel engine-driven screw air compressors.

This project entailed replacing the two existing 228 hp, 2100 rpm-rated diesel engines that drive the compressors with two new 150 hp, 1770 rpm-rated electric engines. The electric motors are high efficiency motors with nominal efficiencies of 94% for the 150hp drive motors, as compared to a standard 150 hp engine at 88%.

Status: The project was completed in June 1990 with the installation of the motors. TTEM has been unable to gather accurate monitoring information due to political instability in the region. A site visit is planned as soon as the area is stable.

Cost and Economic Assessment

The total project cost is estimated to be P950,000, for which the TTEM DLF contributed about 74 percent of the cost (P 700,000) and Benguet funded the remaining cost (P 250,000).

The simple payback period was estimated at 1.51 years, assuming consistent savings over a 10 economic life of the project. The IRR is very favorable at about 66%.

Expected Energy and Monetary Savings

Due to the replacement of the diesel-fired engines the fuel savings are estimated to be about 395 kltrs of fuel oil per year. This represents about a 13% savings in fuel oil for the company. Since the new electric motors will use approximately 1436 mwh of electricity per year, the net total energy savings is expected to be 125.9 BOE per year. The total net savings represent more than a 4% overall energy savings. The TTEM project staff has estimated the monetary savings, using NEMA Standards. If the unit was operated at the ideal continuous rate of 150hp, it would save P 177,200 annually in energy costs and an additional P450,000 annually in maintenance costs. The total estimated cost savings are about P 627,200.

National Impact of Project

Implementation of energy efficient motors have a significant savings of 4% overall. Many plants that now use old deisel engines could replace them with new high efficiency electric engines.

3. CENTRAL AZUCARERA DON PEDRO SUGAR MILL

Background and Financial Standing

Central Azucarera Don Pedro Sugar Mill (CADP) is one of the largest sugar mills in the Philippines. It is located at Nasugbu, Batangas. The company produces 1,440,000 piculs of sugar, 9,190,000 liters of alcohol and 4,410,000 kilos of liquid CO_2 annually. The facility operates 3400 hours annually. The company is in good

financial standing with cash assets of P25.1 million, total assets of P 270 million and total debt/ equity ratio at 0.8.

Project Description

The energy efficiency project at CADP entailed improving the power factor of the induction motors in the plant. Most of the motors in the plant are inductive and therefore result in a lower power factor during operation. The project was estimated to increase the power factor from 76 percent to 85 percent through properly installed and sized capacitors.

Status: The project was completed in March 1990. Project monitoring is well under way and a case study report was completed in November 1990.

Project Cost and Economic Assessment

The total project cost is estimated to be P680,000, for which the TTEM DLF contributed 75 percent of the cost (P 510,000) and CADP funded the remaining amount. The simple payback period was estimated at 1.8 years, assuming consistent savings over the 10 year life of the project. The internal rate of return is expected to be about 65%. This is very favorable compared to the prevailing commercial interest rate of 17% to 18% and the TTEM interest rate of about 14%.

Expected Energy and Monetary Savings

The project is estimated to save 78,882 kwh per year, equivalent to 129,400 BOE per year. This represents a reduction in electricity losses of about 25%. The monetary savings are expected to be P 379,400 per year.

National Impact

This project is expected to reduce the electric losses of the plant by 25 percent. This is a substantial savings per plant. The TTEM project paper estimated that about 215 plants could implement this technology. If even a third of these plants installed power factor correction equipment the savings would be substantial.

4. PHILIPPINE LONG DISTANCE TELEPHONE COMPANY

Background and Financial Condition

Philippine Long Distance Telephone Company (PLDT) is the largest telephone company in the Philippines of the 56 entities providing telephone services. It has a network of 98 central offices serving Metro Manila and 113 other cities and municipalities throughout the country. PLDT manages 94% of the telephones in the Philippine service system.

PLDT has excellent financial standing, with total assets of P21.3 billion at year end 1987. PLDT's assets have been increasing at an average of 11.7% per annum. The company's total debt to equity ratio decreased from 3.8 in 1985 to 2.4 in 1987. This was achieved by increasing capital and reinvesting profits in operations. The company has an excellent credit rating.

Project Description

PLDT has two buildings, Ramon Cojuangco Building (RUC) (14 story, 16,000 sq.m. of air conditioned space) and the Makati General Office (MGO) (10 story, 17,200 sq. m. air conditioned space) which are located across the street from one another. The project entailed linking the air conditioning systems of the two buildings together. This would create one centralized system and upgrade the overall system. The project involved 1) installing primary and secondary chilled water pumps, chilled water piping system, and an electrical system for the linkage; 2) dismantling the existing piping system in each building; and 3) installing additional air handling units and air distribution system in the RUC building. The installation of this equipment allows optimal, efficient and reliable operation, therefore saving energy.

Status: The project is 99% complete with only some final tie-in-work to be completed. All major equipment is installed.

Project Cost and Economic Assessment

The total cost of the PLDT A\C plant linkage is estimated to be P6,377,700. The TTEM-DLF funded P4,200,000 of the cost and the remaining cost, P2,177,700 was funded by PLDT. The project was estimated to have a payback period of about 4.7 years, which was higher than most projects but still under the TTEM project acceptance criteria of 5 years. The calculation of simple payback assumes that the savings will be constant over the 10 year life of the project. The IRR was estimated to be about 16.5%. This rate is acceptable compared to the TTEM interest rate for this project of 13.4%, but was not considered favorable against the prevailing commercial interest rate of 17% to 18%. Despite the unfavorable IRR, the project

was implemented and the resultant savings may turn out to be greater than expected.

Expected Energy and Monetary Savings

The estimated energy savings of the PLDT project are 593,800 kwh/yr. This represents about a 9.5% savings in energy costs. The monetary savings are expected to be about P1,365,000.

National Impact

The 9.5% savings (593,800) expected from this project are considerable. The TTEM Project Paper identified that about 1200 buildings over 3,200 m^2 were built between 1966 and 1983, in Metro Manila. This does not include areas outlying Metro Manila. These buildings contain old inefficient air conditioning systems and offer a great potential for energy conservation. Since the savings per building are so great and similar projects are replicable, further implementation of this technology will have a significant impact on reducing electric savings.

5. REPUBLIC CEMENT CORPORATION

Background and Financial Standing

The Republic Cement Corporation (RCC) began its operation in 1957. RCC was the fourth cement plant established in the Philippines and the first to use the dry manufacturing process. The plant, located in Bo Minoyan, Norzagaray, Bulacan, produces both portland and pozzolan cement. With the upturn in the economy in 1987, a resultant 41% increase in cement demand occurred. Consequently Republic Cement Corporation's production rose 38% to its current level of 852 million tons of cement per day. With expected expansion and increasing demand the company made plans to expand its operation as well as improve plant efficiency. Energy efficiency is a top priority because energy costs make up 75% of the plant's operating costs.

Due to the increased business, the company pulled out its debt which had reached P11.6 million by the end of 1986. The company now has a net worth of P424.8 million. The company's debt/equity ratio since 1987 remains at about 0.5. The credit rating of the company was determined in TTEM evaluation to be good.

Project Description

The Republic Cement plant contains four kilns used to process cement. Once the raw feed has gone through the drying process in kiln four it goes through a four stage cyclone and heat exchanger process which drives off CO_2 from the raw cement feed

(pre-calcination) and separates the unwanted dust from the useful material. In stage one of the process, a fan draws hot gases from kiln four which in turn force the raw materials up through an initial heat exchanger and deposits it into two first stage preheater cyclones. Hot air from a clinker cooler is also added as secondary air to the first stage cyclones to more fully utilize the otherwise wasted heat from the system.

In assessing the system, it was found that the capacity of the first two stage cyclones was restricting the efficient use of the secondary air from the clinker cooler and the flow of air through the system. Also, the cyclones were not insulated causing unnecessary heat loss. Other leaks in the system were discovered causing heat loss and cool air infiltration. Therefore, the project entailed replacing the first two stage cyclones with higher capacity units, insulating them and patching the leaks in the system. The pressure drop across these first stage cyclones represented 30% of the pressure drop for the entire system. Therefore, increasing the capacity of the cyclones is expected to reduce the pressure drop across the entire system, and allow more efficient heat exchange and air flow. The increase in capacity of the two cyclones was also estimated to allow a production increase of about 5 to 10 percent (from 852 to 892 MT/D). Even with the increase in production no energy use increase is expected. The energy intensity for the entire system was estimated to be reduced by approximately 5 percent.

Status: The project was completed in early November 1989. Performance monitoring has verified that the reduction in pressure drop was achieved across the first stage cyclone. Energy intensity has also been reduced within the estimates of the evaluation. A complete case study for this project is being prepared and will be issued in December 1990. The project is expected to be replicated in other cement plants as well.

Project Cost and Economic Assessment

The total project cost is estimated to be P7,669,000. Fifty five percent, or P4,270,000 was funded through the TTEM-DLF and the remaining P3,399,000 was funded through the company.

The project was estimated to have a payback period of about 2.3 years. The calculation of simple payback assumes that the savings will be constant over the 10 year life of the project. The IRR was estimated to be very favorable at about 43%.

Expected Energy and Monetary Savings

The expected annual energy savings of the Republic Cement Corporation's project are 321,100 kwh of electricity and 2,650 MT of coal per year. The total estimated

energy savings are 8874 BOE per year. The monetary savings are estimated at P 0.530 million for electricity and P3.04 for coal, giving a total savings of P 3.390 million.

National Impact

RCC's waste heat recovery project is expected to lower the plant's energy intensity by 5%. In the Project Paper it was estimated that about 700 firms could implement similar technologies. Since the energy savings are significant and the project offers good financial return, a significant impact on energy reduction could be achieved through replication.

6. CAGAYAN ELECTRIC POWER and LIGHT COMPANY, INC.

Background and Financial Standing

Cagayan Electric Power and Light Company, Inc. (CEPALCO) was registered as a private investor-owned utility company with the Securities and Exchange Commission in July, 1958. CEPALCO was permitted to serve the city of Cagayan de Oro in 1961, using its own 400 kw generation plant and 2.4 KV distribution system. With company expansion and the formation of the National Power Corporation, CEPALCO's main function became electric power distribution. The company purchases approximately 800 kw of power from NPC and distributes electric power to approximately 40,000 customers in the areas of Cagayan de Oro City, the Municipalities of Tagoloan, Villanueva, and Jasaan in Misamis Oriental. CEPALCO distributes approximately 119.2 million kwh of electricity annually.

The company has a strong financial standing, with total assets in 1988 at P 57,675,000 and an acceptable debt/equity ratio of 0.29. CEPALCO was rated as having "AAA" or best quality grade credit ratings.

Project Description

CEPALCO's DLF Project entailed reducing electrical energy losses which occur during transmission and distribution. CEPALCO draws approximately 800 kw of electric power from the National Power Corporation at 69 KV. Electric power is transmitted at 69 KV to CEPALCO's substations where it is transformed to primary distribution voltages of 34.5 KV and 13.8 KV. The electricity is then transferred through primary distribution lines to distribution transformers where it is transformed to 220 volts. Electricity at 220 volts is distributed through secondary distribution lines to commercial/residential customers. Electric line losses occur as a result of the heat produced from the electricity passing through various conductors and transformers within the transmission and distribution system. Unbalanced loading of the lines also contributes to the electrical losses. CEPALCO's project was

projected to reduce line losses by about one percent of the electric power supplied to its system by NPC.

A reduction in line losses was achieved by overhauling and updating the existing transmission and distribution system. This included:

1. Installation of a new computer system, data base and computer models to operate the T & D system more efficiently.

2. Load and line loss studies with new metering equipment and installation of new monitoring equipment to better track and remedy losses.

3. Installation of new power capacitors to reduce losses from transformer equipment.

4. New testing instruments to measure the loss characteristics of distribution transformers, assess where losses are occurring within the system, and reorganize the distribution system to optimize the ratings of distribution transformer stations.

5. Assessing and performing load balancing and load redistribution and revisions of the primary lines.

Project Cost and Economic Assessment

The total project cost is expected to be P5,746,000, for which the DLF contributed 73 percent of the cost (P4,200,000) and CEPALCO funded the remaining cost (P1,546,000). The simple payback period was estimated at 4.1 years (assuming consistent savings over the 10 year life of the project). The internal rate of return is expected to be about 20.1% which is favorable compared to the TTEM interest rate of 14%.

Expected Energy and Monetary Savings

The project is estimated to save about 2,145,000 kwh per year which is equivalent to about 3517 BOE per year. This represents about 1.8 percent of the total kwh distributed by the system. The monetary savings are about P1,608,800 per year. Since the new systems would increase operating costs by P213,300 per year, the actual annual savings would be approximately P1,395,500.

National Impact

The A.D. Little report used in the TTEM Project Paper estimated that electricity made up 32% of all energy used in industries. Based on their audit reports, about 55% of the industries had a power factor below 95%. Since industrial energy use represents more than half of the energy consumed in the country, the improvement of power factors would have a significant impact on electricity consumption.

7. ARMCO-MARSTEEL ALLOY CORPORATION

Background and Financial Standing

Armco-Marsteel Alloy Corporation (AMAC), established in 1972, is a private corporation owned by three main investors: Marsteel Corporation, Armco Steel Corporation, and Philex Mining Corporation. The daily operation of the company is managed by Armco, Inc.. The company has a 32,500 metric tons capacity steel ball grinding facility in Novaliches, Quezon City, and a steelworks plant in Taguig, Metro Manila, which produces 20,000 metric tons of unfinished steel billets.

In 1988, Armco-Marsteel had total assets of P233,148,000 and a debt/equity ratio of 0.82, showing a solid financial standing. The company also has an acceptable credit rating.

Project Description

The DLF project at the Armco Marsteel steelworks plant entailed improving the efficiency of the Electric Arc Furnace (EAF) which is used to heat, melt and refine unmelted scrap/molten steel. Despite the tremendous heat created by the three graphite electrodes within the EAF, "cold spots" in between these electrodes was causing the melting process to take longer and to use energy inefficiently. In order to have a more complete and efficient melting process, an Oxy-fuel Burner System was installed with a multi-stage blower and programmable logic controller-based control system. The burners were mounted on the wall of the furnace and directed down towards the cold spots between electrodes. This additional heat was expected to improve the efficiency of the furnace by about 12 percent. In addition, each batch could be melted more quickly, resulting in an expected increase in production of approximately 15 percent.

Status: The project was completed in March 1990. Commissioning extended through June, and performance data was gathered thereafter. The initial performance data indicates that the project is performing better than expected. A complete case study will be prepared and issued in December 1990.

Project Cost and Economic Assessment

The total project cost is estimated to be P5,870,000, for which TTEM DLF contributed 72 percent of the cost (P4,200,000) and Armco Marsteel Company funded the remaining cost (P1,670,000). The simple payback period was estimated at 2.2 years, assuming consistent savings over 15 year life of the project. The IRR is expected to be about 45% which is very favorable compared to the TTEM interest rate of 14.5% and even competitive with the prevailing commercial interest rate of 21%.

Expected Energy and Monetary Savings

Before the DLF project was implemented the EAF had an average capacity of 26 MT molten steel per batch and a total daily production of 208 MT. Energy use before the DLF project was approximately 685 KWH/MT. The project is expected to save about 85 KWH/MT which represents about a 12 percent reduction in energy intensity. This is expected to deliver a yearly savings of 4260 MWH (6995 BOE). The oxy-fuel burners are expected to increase annual output by 16% and have been estimated to use 853.9 kltrs of fuel oil per year. Taking into account the fuel use of the burners, the overall expected energy savings are 1617 BOE per year. The expected net cost savings are about P2,710,000.

National Impact

In 1981, the industrial sector consumed 55% of the total energy consumption in the country. Out of this, the steel/metal industry represents about 4% of the industrial sectors energy consumption. There are 15 furnaces in 12 steelworks plants in the Philippines, with an estimated total production capacity of 800,000 tons per year. Armco-Marsteel Alloy Corporation and the National Steel Corporation plant have both installed oxy-fuel burner systems, but the other 10 plants could also substantially reduce their energy consumption. Since each plant would likely save about 12 percent of its energy use, the adoption of this technology by these plants would have a significant impact on reducing national energy consumption of electricity.

8. ARAS-ASAN TIMBER COMPANY, INC.

Background and Financial Standing

Aras-Asan Timber Company, Inc. (ARTIMCO) was first registered with the Securities and Exchange Commission in 1953, as a private domestic firm which engages in logging and wood processing. ARTIMCO produces and trades Philippine mahogany and albizia facat logs, veneer, plywood, blockboard, and other lumber products. The manufacturing facilities are located in Bo, Aras-Asan, Cagwait, and Surigao del Sur. ARTIMCO has a Timber License Agreement covering a logging

concession of 24,230 hectares and a yearly cut allowance of 61,942 cubic meters of logs. The company also has an Industrial Tree Plantation Lease Agreement with the Department of Environment and Natural Resources (DENR) for 1600 hectares. ARTIMCO has been involved in reforestation and was awarded the first DENR contract of P3.7 million for reforestation of 281 hectares.

Due to a slump in the lumber and wood business in the late 70's through 1987, ARTIMCO was operating with a deficit of P0.93 million and a negative equity of P19.6 million in 1987. Despite the deficit, the company had P51 million in assets in 1987. Their initial status improved in 1989, when additional equity of P19 million was infused into the company accounts. Despite the financial difficulty experienced by the firm, the 1988 Corporate Credit Rating Guide rated ARTIMCO at "BB" or upper medium grade.

Project Description

The DLF project involved upgrading and repairing the steam distribution system at one of ARTIMCO's manufacturing facilities. A site visit by the TTEM staff revealed that the system had been leaking, had been improperly installed, had no condensate drainage or air venting, and was inefficient overall. To remedy these problems, the DLF project entailed:

1. Providing steam mains and headers with proper drainage and air venting.

2. Insulation of steam lines.

3. Proper positioning and drainage of steam supply lines to process equipment.

4. Installation of high quality and properly sized steam traps on all process equipment.

5. Installation of equipment in order to recover the flash steam that occurs in the initial stages of the driers for use in the last stage of the drier.

6. Installation of a proper condensate recovery system.

Although not part of the DLF project, a non-functioning desuperheater also needed to be rehabilitated in order for the system to maximize energy savings. This was to be completed and funded by ARTIMCO.

Status: The project was completed in June 1990. Performance data is being gathered and analyzed, and a case study report will be issued in December 1990.

Project Cost and Economic Assessment

The total project cost is estimated to be P2,300,000 for which the TTEM DLF contributed almost 74 percent of the cost (P1,700,000) and ARTIMCO funded the remaining cost (P600,000). The simple payback period was estimated at 1.78 years, assuming consistent savings over the 7 year economic life of the project. The IRR is about 53%, which is very favorable compared to the TTEM interest rate of 14.75%.

Expected Energy and Monetary Savings

The project was estimated to save about 20.6 million lbs of steam per year. This is about 43% of the steam used before the project was implemented. Savings of 20.6 million lbs of steam per year is expected to achieve a 21% reduction in fuel savings. Since wastewood is used for fuel a savings of 5,482 MT of wastewood is expected to be saved annually. This is approximately equivalent to 7674 BOE per year.

National Impact

The TTEM Project Paper estimated that about 940 plants in the industrial sector which have steam boiler systems where these technologies could be applied. There are likely more plants than those identified. If all of these firms implemented similar steam system improvements, a significant reduction in energy loss would be achieved.

9. CENTRAL FERMENTATION INDUSTRIAL CORPORATION

Background and Financial Standing

Central Fermentation Industrial Corporation (CFIC), is a 100% Filipino-owned corporation which was begun in 1975. CFIC is located in Bo. San Vicente, Apalit, Pampanga. The company manufactures and sells ethyl alcohol and other related products. Before the DLF project was implemented, Central Fermentation produced 80,000 liters of ethanol per day and 12 million liters per year. The company also operates a digester which produces bio-gas to fuel the boilers in its manufacturing facility.

CFIC showed a net profit in 1988 of P 0.62 million and was found to have a relatively stable financial condition. The company's total assets in 1988 were P 47 million but its debt/equity ratio was rather high at 4.9. Overall the financial standing of the company is good as shown by its long term debt/equity ratio of 0.62. CFIC's credit rating was found to be satisfactory according to three banks checked by TTEM staff.

Project Description

CFIC's DLF project involved the installation of a cogeneration system to meet the electric and steam requirements of the ethanol plant at twice its production capacity (24 million liters of alcohol per year) and to reduce overall energy use. Installation of the cogeneration unit involved installation of a new boiler rated at 50,000 lbs/hr (at 300 psi, 572 F) and a 1175 KW turbo-generator set. Turbine exhaust heat at 50 psi would be extracted for use in the process. The boiler runs on both bunker oil and bio-gas. The bio-gas is expected to displace between 17 to 34% of the bunker oil.

The installation of the new boiler replaced two wood fired boilers (rated at 6,900 lbs/hr steam, 80psi) and two oil-fired boilers (20,00 lbs/hr steam, 80 psi and 6,900 lbs/hr steam at 75 psi). This equipment used 14,000 MT of wood, 2,200,000 liters of bunker fuel oil (BFO) and 2,150,000 kwh of purchased electricity at a total cost of P19,145,900 per year to produce 12 million liters of alcohol per year.

Status: CFIC completed installation of the equipment in October 1990. Commissioning activities are still in progress and the unit is expected to be on-line before the end of the year. The project will be monitored in 1991 and a case study issued.

Project Cost and Economic Assessment

The total project cost is estimated to be P 19,200,000, for which TTEM DLF contributed about 22 percent of the cost (P4,200,000) and CFIC funded over 78 percent (P 15,000,000). The simple payback period was estimated at 1.7 years if the bio-gas is used to displace the bunker oil and assuming consistent savings over the 10 year economic life of the project. The IRR is about 59%, compared to the TTEM interest rate of 14.75% and the prevailing commercial interest rate of 21%.

Expected Energy and Monetary Savings

The operating costs are expected to drop from about P1.6/liter of alcohol produced to about P 1.1/liter of alcohol. This represents about a 30% reduction in costs or P 11,527,000 in energy and operating costs would be saved per year. Additional savings will likely occur because plant efficiency and production will improve without frequent power outages. The annual energy savings are expected to be about 341 kltrs of fuel oil or 5189 BOE. This assumes the plant produces 24 million liters of alcohol per year and that bio-gas is used to supply about 17% (about 2.4 million liters of oil) of the fuel for the boiler per year.

National Impact

In the Philippines, there are 27 sugar plants, 20 food processing plants and 18 coconut/vegetable oil manufacturing plants which could install similar cogeneration plants. Since the energy cost savings are about 30 percent implementation in even ten of these plant would have a significant impact on reducing fuel consumption.

10. RUBBERWORLD PHILIPPINES, INC.

Background and Financial Standing

Rubberworld Philippines, Inc. (RWPI) was first registered as a private investor-owned corporation in 1965 and is 100% Filipino-owned. The company's main product is rubber shoes. The company has an exclusive manufacturing contract with Dunlop, Inc. of Australia to manufacture its "Grosby" brand shoes. It also manufactures Adidas sport shoes and other name brand rubber shoes. Rubberworld has a total of 8 manufacturing plants, located in Bo. Talipapa, Novaliches, and Quezon City.

RWPI is in good financial standing, with paid-up capital stock of P 236 million and a total stockholder's equity of P531 million by the end of 1988. The company has maintained an average debt/equity ratio from 1986 to 1988 of 1.4, and had an average long term debt/equity ratio of 0.32 over the same period. The company has a good credit rating.

Project Description

RWPI's DLF project aimed at optimizing its steam production and improving its steam distribution system. In assessing RWPI's plants, it was found that there were 3 boilers that served its 5 RWPI plants and only one that served its three Adidas plants. These separate systems caused an imbalance and inefficiency in meeting the steam requirements of all the plants, especially for the Adidas plants. To remedy this situation a central boiler and steam system was created by installing a new high efficiency (84%) 300 HP Cleaver-Brooks boiler and relocating, connecting and rehabilitating its existing steam distribution systems. The new boiler was used to replace the three less efficient (70-75% efficiency) boilers serving the RWPI plants and the fourth boiler (serving the Adidas plant) was used as a backup for the system. This centralization scheme is expected to ensure proper boiler load monitoring and balancing to make the whole system efficient and effective.

Status: The project was completed in September 1990 with the installation of all equipment. Performance data is being gathered and analyzed, and a case study will be issued in December 1990.

Project Cost and Economic Assessment

The total project cost is estimated to be P4,071,500 for which the TTEM DLF contributed about 74 percent of the cost (P3,000,000) and RWPI funded over 26 percent (P1,071,500). The simple payback period was estimated at 2.2 years, assuming consistent savings over the 10 year economic life of the project. The IRR is expected to be about 44%, compared to the TTEM interest rate of 15% and to the prevailing commercial interest rate of about 21%.

Expected Energy and Monetary Savings

In 1988, the existing system at the RWPI and Adidas manufacturing plants utilized 1,839,900 liters of fuel oil and 336,400 KWH of purchased electricity at a total operating cost of P6.3 million. The expected reduction in consumption with the new system is approximately 524,000 liters of fuel oil (based on a new boiler efficiency of 80%) and about 224,900 KWH of purchased electricity per year. The total estimated energy savings are equivalent to 3662 BOE per year or 28% of the total energy used. The expected monetary savings are about P1.6 million per year of fuel oil and P0.3 million pesos per year of electricity. The projected savings of the new boiler is a conservative estimate as it assumes the boiler efficiency will only reach 80% while the manufacturer claims an efficiency of 84%.

National Impact

RWPI's project could be replicated in more than 940 industrial plants in the Philippines as estimated in the TTEM Project Paper. Since up to 28% of the energy could be saved in each plant widespread implementation would have a significant impact on reducing bunker oil consumption.

11. UNION GLASS AND CONTAINER CORPORATION

Background and Financial Standing

Union Glass and Container Corporation (UGCC) was registered as a private investor-owned corporation with the Securities and Exchange Commission in 1957. UGCC is 76% Filipino-owned and 24% American-owned. The company develops, manufactures and processes glass products and containers. UGCC headquarters and manufacturing facilities are located in Bo. Ugong, Pasig, and Metro Manila. The manufacturing plants produce two lines of glass containers, one with a capacity of 100 metric tons per day and one with a capacity of 60 MT/day.

The company operated at a loss of P 12 million in 1986 but recovered in 1988 with a net income of P 10 million in 1988. Despite the depressed market in soft drinks and liquor sales, the company has held a fairly steady financial standing. An average

debt to equity ratio over the years 1986 to 1988 was fairly high at about 3.0, but its long-term average debt to equity ratio of 1.0 shows UGCC to have acceptable finance strength. The company has maintained a good credit rating over the last 5 years.

Project Description

UGCC's manufacturing facility contains two separate glass container production lines, each consisting of a melting furnace, batching system, glass forming machines and annealing lehrs. The DLF project involved improving the efficiency of the furnace used for line two.

In 1981, the company had rehabilitated and expanded Furnace No. 1 of its first line, to improve its energy intensity by 20% from 125 ltrs fuel oil per metric tons of glass to 100 ltrs/MT. The second line has not been upgraded since 1978; its energy requirements have increased almost two-fold from 150 ltrs fuel oil/MT to 280 ltrs/MT and its capacity has decreased by 45 MT/day. To improve the efficiency of Furnace No. 2, a secondary regenerator was installed and more insulation was added. In addition, an automatic combustion control system with oxygen trim control, coupled with an improved process control system, was installed to improve the combustion efficiency of the furnace. The forehearth was also replaced with a more efficient model. The improvements to the system will increase the capacity of furnace no. 2 from 60 MT/day to 100 MT/day.

Status: UGCC completed the project in October 1990 and the furnace was successfully commissioned. Performance monitoring is now in progress and a case study report will be issued in 1991.

Project Cost and Economic Assessment

The total estimated cost is P15,554,000 for which the TTEM DLF contributed about 28 percent of the cost (P4,300,000), and UGCC funded over 72 percent (P11,250,600). The simple payback period was estimated at about 3.9 years, assuming consistent savings over 10 year economic life of the project. The IRR is estimated to be 22.5%, compared to the TTEM interest rate of 15% and to the prevailing commercial interest rate of 21%.

Expected Energy and Monetary Savings

The project is expected to reduce fuel use by 19% (1.05 million ltrs of fuel oil/yr), and reduce LP gas input by 63% (310,200 kg/yr) of LPG. The total monetary savings to the company is expected to be P 4.03 million annually in fuel and operating costs. The estimated energy savings for each component of the project are as follows.

1. Installation of the insulation and secondary regenerator was expected to reduce energy intensity by 17% or 25 liters/MT which is equivalent to a savings of 912,500 liters of fuel oil/year.

2. Installation of automatic combustion control system was expected to reduce flue gas losses by 3%, which is equivalent to about 136,800 liters/year.

3. Installation of the new BH-F 400 series forehearth was expected to reduce LP gas usage by 63% or 8.5 kg/MT of product. Thus a yearly savings of about 310,200 kg/yr of LP gas is expected.

National Impact

In 1981, the glass manufacturing industry represented approximately 6% of the total industrial energy consumption. The industrial sector consumed over 55% of the total energy consumption in the country. There are mainly 11 plants including UGCC which make up the glass manufacturing industry. Each of these glass manufacturing companies consume in the range of 50,000 to 250,000 barrels of oil equivalent per year. Assuming the other 11 plants consume approximately the same amount of fuel as UGCC, over 10 million ltr/yr of fuel oil and 3 million kg of LPG could potentially be saved per year, if they were to install similar technologies. This would have a significant impact on the national consumption of oil.

12. BELL CARPETS INTERNATIONAL MANUFACTURING, INC.

Company Background and Financial Standing

Bell Carpets International Manufacturers, Inc. was established as a private Filipino investor-owned business in 1984. The company is one of the largest manufacturers of carpets in the Philippines, with a production rate of approximately 82,000 m^2 annually. The company sells their products both domestically and to export markets. The manufacturing plant is located Bagumbayan, Taguig, Metro Manila.

As of year end 1988, Bell Carpets had an authorized capital stock of P13 million, stockholders' equity of about P 12 million and total assets of about P 16 million. Over the period 1987 to 1989 the debt to equity ratio decreased 0.52 to O.33. The company has an acceptable credit rating.

Project Description

Bell Carpets DLF project entailed importing and installing a 125-KW Diesel engine generator set. The cogeneration unit is expected to supply most of the electricity supplied to the plant by the electric distribution utility, MERALCO. The heat from

the exhaust gases of the unit will supply heat through a new heat exchanger to the existent 85 HP steam generator (or boiler).

Status: The project was 10% complete as of October 1, 1990. The company will not use the existing DLF to fund the project because its construction will not have been completed by the PACD. The project will be funded by the reflows from the DLF.

Project Cost and Economic Assessment

The total cost of this project was P1,158,300 including the purchase and installation of the engine generator set and the heat exchanger plus necessary accessories and contingencies. The cost of the project will be funded both by TTEM reflows in 1991, P850,000 (73%), and Bell Carpets' resources of P308,300 (27%). The expected payback period and IRR were calculated to be almost 4 years (assuming savings to be constant over the 12 year project life) and 23%, respectively.

Expected Energy and Monetary Savings

The existing boiler system consumed approximately P740,200 worth of fuel oil per year. The expected savings due to utilizing the recovered heat from the new generator set was P84,900 or equivalent to about 12%. The company also purchased 468,000 kwh/yr from MERALCO at a cost of P765,200 per year (at P1.635/kwh). The cost of generating the company's own electricity was expected to be about P534,800 annually, delivering a 30% cost savings of P230,300 per year. The combined savings, minus a P0.05/kwh maintenance cost, was expected to be P291,800. The net energy savings is expected to be about 750 BOE per year.

National Impact

The industrial sector consumes approximately 55% of the energy consumed in the country. There are many plants which could install cogeneration systems such as Bell Carpets. This could have a significant reducing impact on fuel oil use. Since the country is currently experiencing severe electricity shortages and legislation has been passed to encourage the National Power Corporation to purchase power from small independent power producers, there are good incentives for firms to invest in this technology. The IRR and relatively short payback are also good incentives for investment.

13. BACNOTAN CONSOLIDATED INDUSTRIES, INC.

Company Background and Financial Standing

Bacnotan Consolidated Industries, Inc. (BCI), previously incorporated as Bacnotan Cement Industries, Inc., was established as a private Filipino investor-owned business in 1957. The company started out with just one cement plant in Bacnotan, La Union, where the DLF project was implemented. This plant is managed by the Philippine Investments Management Consultants, Inc. (PHINMA). The Bacnotan plant currently has a rated capacity of 830 tons of clinker per day, making it one of the largest cement plants in the country.

In 1963, BCI began to diversify into corrugated sheet steel plants and other operations. BCI has partial ownership of 6 subsidiaries, Central Cement Corporation, Davao Union Cement Corporation, Atlas Cement Corporation, Luzon Bag Corporation, United Pulp and Paper Company, and Industrial Energy Ventures, Inc. (a coal mining company). BCI is the sole owner of three corrugated sheet steel plants.

As of year end 1989, the company had authorized capital stock of P160 million, stockholders' equity of P 954 million and total assets of P 1187 million. During the period 1987 to 1989 the company operated at a net profit margin of almost 18%. This is considered good or better than industry standards. Over the period 1987 to 1989 the debt to equity ratio averaged about 0.23. This shows that the company is able to adequately cover its debt with its capital stock. The company has the best quality credit rating.

Project Description

BCI's project was implemented to improve the operation and efficiency of kiln #1 through the installation of a programmable logic control system. The project entailed the installation of process programmable controllers to monitor and simultaneously control combustion, slurry feeder, kiln speed and temperatures, gas temperatures at various points within the system, and heat recovery processes in the clinker cooler and calcinator.

The savings from the project are expected to be largely drawn from the ability to monitor and control the operation of the kiln at an optimal level. This is expected to require less fuel input per clinker output. The control system will be kept simple, so that the operators could be easily trained to use it.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is estimated to be P1,600,000 including the purchase of the control system (P819,300), design and engineering (P500,000), and a 20% contingency factor. The cost of the project will be funded by TTEM, (P1,200,000 or 75%), and BCI resources of P400,000 (25%). The expected payback period and IRR are expected to be approximately 2 years (assuming savings to be constant over the 5 year project life) and 44%, respectively. This IRR was attractive to BCI, in comparison to the TTEM interest rate of 18%, and the market rate of 20% to 26%.

Expected Energy and Monetary Savings

The project is expected to save 1,096 MT of coal per year (3868 BOE/yr), which is about 3.3% of the total energy that was consumed per year. This is equivalent to a total annual monetary savings of P1.4 million.

National Impact

There are many plants which have process equipment and kilns which could save at least 3% per kiln. If several of the plants installed process controls of this type, the impact on reducing national fuel oil or coal consumption could be significant.

14. ILIGAN LIGHT AND POWER, INC.

Company Background and Financial Standing

Iligan Light and Power, Inc. (ILPI), was established as a private Filipino-owned electric distribution utility in 1976. The company is one of the top 10 largest distribution utilities. ILPI has a distribution capacity of 22 MW and uses about 24 million kwh to serve Iligan City and its suburbs. The company purchases its power from NPC at 69 KV and delivers power to consumers at 220 V.

ILPI has shown strong financial standing over the past five years. At the end of 1988 the company had a total stockholders' equity of P44,802,100, total assets of P57,675,000, and a debt to equity ratio of 0.29. The company only has a P2.32 million in long term debt. ILPI has an "AA" or superior quality grade credit rating.

Project Description

ILPI's project is an electric power loss reduction project, which entails moving and/or adding transformers and electric lines in order to center the load and distribute electric power more efficiently. The existing distribution and transmission system consists of 1) primary lines from NPC to transformers, located on highways which were a significant distance from residences and businesses, and 2) secondary lines

from the transformers to the customers. Since the transformers were located so far from the main load areas or centers, electricity would often be delivered at a lower voltage than 220 V and significant line losses would be incurred due to the extreme length and resistance of the secondary lines.

To improve these inefficiencies, new primary distribution lines are under construction that branch from existing distribution lines to load centers (near the consumers), where transformers were installed and secondary lines to the consumers were reconnected to the new transformers. The project is expected to reduce line losses by about 35 percent and to improve the quality of the electricity delivered to the consumers.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is expected to be P6,124,100 which was divided between design cost (P167,000), equipment cost (P5,567,300) and installation cost (P89,700). Cost of design included a field survey, line staking and drafting of plans. Equipment costs mainly included transformers, line hardware, transformer protection equipment and related materials.

Funding for the project was split by TTEM and ILPI, at P4.1 million (73%) and P1.62 million (27%). The expected payback period and IRR were calculated under two different scenarios: 1) If the company purchased less electric power from NPC, thereby maintaining revenue, then a payback of about 5 years (assuming the life of the project is 20 years) and an IRR of 20% were expected; or 2) If the company sold its new "surplus" power, thereby increasing revenue at the present cost, a payback of about 2 years and an IRR of 49% was expected. ILPI most likely decided to sell surplus power (scenario 2), since their customer demand had been steadily increasing.

Expected Energy and Monetary Savings

The project is expected to save 35% of the line losses existing before the project was completed. This should result in an energy savings of about 1,760,400 kwh/yr (2887 BOE) or about 2% of the total purchased energy initially purchased from NPC. The increase in secondary line capacity is equal to the amount of reduction in peak line loss, or about 440 kw of surplus capacity. The monetary savings were estimated to be about P3 million.

National Impact

There are currently 160 distribution utilities that could implement this technology and the resultant energy savings would have a significant impact on reducing consumption within the electric utility system and the overall national consumption.

15. TRUST INTERNATIONAL PAPER CORPORATION

Company Background and Financial Standing

Trust International Paper Corporation (TIPCO) was established as a private Filipino (60%) and foreign (40%) investor-owned business in 1987. The company is in a joint venture with Tigon Enterprises and Advent Enterprises of Taiwan and several Filipino partners of Bataan Pulp and Paper Mills, Inc. The company is engaged in the manufacture of paper products, pulp, and waste paper, for both domestic and export markets. TIPCO manufacturers newspaper and econobond paper at a rated capacity of 12,000 MT per year. The plant is located in Mabalacat, Pampanga.

Since TIPCO is a newly formed company, its financial performance in 1988 and 1989 delivered a negative yield. This is fairly normal due to the fact that it is still trying make a stance in the market. The company has total assets of P 614 million, and a debt to equity ratio of almost 11, due to the large debt incurred during company start up. Although TIPCO appears to be weak financially, its performance is expected to improve over the next few years. The company also has a good credit rating.

Project Description

The main goal of TIPCO's project is to increase the current power factor of its inductive type motors from about 76% to about 88.5%. This will be achieved through the installation of appropriately-sized capacitors on all motors 40 hp and above. These motors represent 70% of the load or 9900 kw out of a total load of 14,000 kw.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is estimated to be P3,740,000 including the purchase and installation of the power capacitors and accessories, plus contingencies. The total project cost was funded by TTEM and TIPCO, P2.8 million (75%) and P0.94 million (25%), respectively. The expected payback period and IRR were calculated to be

90

approximately 2.5 years and 39%, respectively. The IRR was very attractive to TIPCO, in comparison to the calculated TTEM interest rate of 17%.

Expected Energy and Monetary Savings

The project is expected to save 947,600 kwh per year (1554 BOE/yr), which should deliver monetary savings of P1,118,200. Savings from avoiding a penalty for low power factor (P285,940) and an added bonus of P96,600 from MERALCO for improving power factor, are expected to add P382,540 to cost savings. Therefore, the total expected savings are P1,500,700.

National Impact

There are hundreds of plants in the Philippines which are operating at low power factors. Low power factors exacerbate the already critical shortage of electric power. The quick payback and very favorable IRR are good incentive for other firms to implement this type of project.

16./17. C. ALCANTRA AND SONS, INC. PROJECTS I AND II

Company Background and Financial Standing

C. Alcantra and Sons, Inc. (ALSONS), was established as a private Filipino investor-owned business in 1962. The company is engaged in the manufacture and export of plywood, blockboard and lumber. The plant is located in Lanang, Davao City with a main headquarters office in Makati, Metro Manila. ALSONS currently uses 14,200 m^3 of wood per year to produce wood products.

ALSONS had shown a strong financial standing during the period 1987 to 1989. At the end of 1989, the company had a total stockholders' equity of P 125.7 million, total assets of P315.1 million, and a debt to equity ratio of 0.40. The company had some financial difficulty before 1987, but it has recovered and is in a good position to undertake this project. The company also has a good credit rating.

Project 1

Description

In assessing the steam system improvement project, the TTEM staff identified several inefficiencies in the system:

1. The plant had 1725 ft. of unlagged steam lines.

2. Condensate from lumber composers and splicers are being discharged to the sewer.

3. About half of the condensate from hot presses and kiln driers are also being discharged to the sewer.

4. Condensate is allowed to flash to the atmosphere from the open tanks.

5. There were an inadequate number of installed steam traps.

To remedy these inefficiencies the following was undertaken for the DLF project:

1. Modification/improvement of the steam trapping system for the veneer dryers, kiln dryers, hot presses and lumber composers.

2. Installation of automatic air vents at the terminal ends of the veneer dryers and kiln dryers to carry over air in the steam lines.

3. Installation of a condensate recovery system that will make use of appropriate pumps and properly sized hot well tanks.

4. Installation of flash steam vessel assemblies at the main condensate return line. The last heating batteries of veneer dryers 1-4 will make use of flash steam.

5. Installation of pressure reducing station to automatic control steam pressure for the hot presses.

6. Insulation of steam lines.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is estimated to be P4,471,000 which was divided between design cost (P283,845), equipment cost (P2,971,600), installation cost (P809,800), and a 10% contingency factor. Equipment costs included installation of steam traps, valves, insulations, piping, and other accessories.
The total project was funded by TTEM and ALSONS, P3.3 million (74%) and P1.17 million (26%), respectively. The expected payback period and IRR were estimated to be 2.6 years and 36%, respectively.

-82'

Expected Energy and Monetary Savings

The wood saved by this project was expected to be about 19% of the total wood consumed in the previous year (1989). The project is expected to save 14,213 m^3 or 7817 MT of wood per year. This is equivalent to about 10943 BOE per year. The total monetary savings are estimated to be P1,705,000.

National Impact

The A.D. Little Study used in the TTEM Project Paper estimated that there are over 940 plants in the Manila area which require improvement of their steam systems. Since a similar project could cut energy use by 19%, replication of this project will have a significant impact on reducing energy consumption. The quick payback and very favorable IRR are good incentive for other firms to implement this type of project.

Project 2

Description

ALSONS' second DLF project involved upgrading the steam boiler control system, improvement of existent dampers, and reduction of air infiltration where possible. The installation of the new semi-automated boiler control system included, integrating draft meters, flue gas analyzer, thermocouple, KWH/demand meter, make-up water meter, gear motor for semi-automatic control of dampers from the instrument box, and ammeters.

The boiler control system existing before this project had only limited capability. The system only contained a flowmeter with totalizer, steam pressure recorder, thermometer gage for flue gas temperature, and an ammeter/voltmeter to monitor boiler accessories such as, motor drives for fans and pumps. The flowmeter and the ammeter/voltmeter were the only instruments which gave a reliable reading. The boiler also had problems with air infiltration at the burner and around the dampers, causing inefficient combustion to occur.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total material cost of this project is estimated to be P1,181,400, including importation shipping and handling (10%), VAT (10%) and insurance (2%). With the installation cost of P 452,500, the total cost is expected to be P 2043,700. The total

project was funded both by TTEM and ALSONS, P 1.5 million (73%) and P 0.54 million (27%), respectively. The payback period and IRR are expected to be approximately 3 years and 36%, respectively.

Expected Energy and Monetary Savings

The energy savings from the project were expected to result from reduced/controlled combustion air and reduced load of the fans' motors. The expected savings are 2,424m^3 (2598 MT) of wood and 353 MWH per year. The equivalent percentage reduction in energy and power were estimated to be 3% and 8%, respectively. The total expected energy savings are 4217 BOE per year. The total monetary savings were estimated to be P708,400.

National Impact

The A.D. Little study used in the TTEM Project Paper estimated that more than 900 plants in the Manila area require upgrading of steam boiler systems. Since the percentage energy savings are significant, replication of this technology will have a large impact on reducing fuel and electricity use. The quick payback and very favorable IRR are good incentive for other firms to implement this type of project.

18. MABUHAY VINYL CORPORATION

Company Background and Financial Standing

Mabuhay Vinyl Corporation (MVC) was established as a private Filipino investor-owned business in 1965. The company is the first firm in the Philippines to manufacture polyvinyl chloride (PVC) and the largest producer of caustic soda in the country. The company currently manufactures 30,000 MT of caustic soda, 20,500 MT of hydrochloric acid (HCl), 24,000 MT of PVC resin, and 6,00 MT of liquid chlorine annually. MVC is registered with the Board of Investments as a preferred pioneer enterprise under the Investments Incentives Act, which allows it to be exempt from income tax. The manufacturing facilities are located in Assumption Heights, Iligan City, while its headquarters are located in Makati, Metro Manila.

The company has had a negative financial performance over the past few years. This is shown by the lower than unity current ratio between 1987 and 1989. At the year end 1989, the company's stockholders' equity was a negative P1.3 million and the company had a loss of about P 3 million. These debts were mostly due to large interest charges on loans and by the devaluation of the Philippine peso in the early 80's. The company has a plan to rehabilitate its financial record mainly by using a Direct-Debt-Buy-Out Scheme, where the company will be able to retire most of its loans. Despite its poor financial performance, the company has an acceptable credit rating.

Project Description

MVC's DLF project entailed installing condensate recovery systems on the steam generators in MVC's monomer plant, polymer plant, drying plant, and brine plant. In the existing system, condensate containing heat which could have been reused within the process had been discharged into the canal near the facility. The new condensate system will remedy this situation by collecting the wasted condensate and pumping it back to the feed water tank, where less energy is needed to heat the boiler water to steam. The project entailed installation of insulated condensate tanks, insulated condensate return lines, and hot water pumps. New instrumentation such as a pH indicator alarm, will also be installed. The instrumentation serves to alarm the operator when leakage of corrosive or dangerous substances occurred.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is estimated to be P868,800 including the purchase and installation of pipes and fittings, hot water tanks, condensate tanks, insulating materials, instrumentation and labor costs (35% of equipment cost). The cost of the project was funded by TTEM, P650,000 (75%) and MVC P218,800 (25%). The expected payback period and IRR were calculated to be approximately 0.62 years and 192%, respectively. The IRR was extremely attractive to MVC, in comparison to the calculated TTEM interest rate of 17%, and the market rate of 26% to 30%.

Expected Energy and Monetary Savings

The project is expected to save 426,000 liters of oil per year, which is equivalent to 2679 BOE. The reduction in energy use for boilers one and two in the plants was more than 4.5%. The total expected monetary savings is P1,404,200

National Impact

The TTEM Project Paper estimated that more than 900 plants in the Manila area could install more efficient steam systems. Implementing projects similar to MVC's project could easily be replicated and could deliver a savings of more than 4.5% per project. Thus, adoption of these technologies in only one fourth of the identified plants would have a significant impact on reducing industrial energy consumption. The extremely short payback and excellent IRR offer good incentive for implementing these projects.

19. KALINISAN STEAM LAUNDRY, INC.

Company Background and Financial Standing

Kalinisan Steam Laundry, Inc. (KSLI) was established as a private Filipino investor-owned business in 1985. The company is almost solely owned (96%) by one person. The company launders about 3,650,000 kg of linens per year (20 tons of laundry per day), for commercial, institutional and industrial establishments. KSLI also engages in dry cleaning, and washing and dyeing of garments. KSLI facilities are located in Quezon City.

As of the end of 1989, the company had an authorized capital stock of P 2 million, a stockholders' equity of P 0.78 million and total assets of P 10.6 million. Over the period 1987 to 1989, the debt to equity ratio grew from 1.44 to 12.57. Although this ratio seems high the company was determined to be able to cover its debt service and the cost of project implementation. The benefits of the project were so favorable that recovering the cost of investment were expected to be easily manageable. KSLI has an acceptable credit rating.

Project Description

KSLI's DLF project entails modifying the plant's washing/drying process from its conventional batch process to a fully-automated continuous batch washing system. The new system is a Milnor's continuous batch washing system. This system is modular and its output per hour depends on the number of modules and the cycle time. The system has 8 modules and batches of 50 kilograms are fed into the machine's loading funnel by conveyor or by other means. These batches travel through the continuous batch washer, exit into an extraction system for moisture removal, and then move via conveyor to 2 two batch self-loading dryers. The MILTRON microprocessor-based control system integrates the entire system and allows the operator to monitor and control the system on a computer screen.

The new system replaced the existing system of 25 individual washers and 15 conventional dryers, all of which have operating times of 45 minutes and up. The benefits that will be derived from the new system are: 1) Simplification and reduction of materials handling; 2) Washing is continuous; 3) Requires less water; 4) More efficient dryers mostly due to added insulation; and 5) The system is fully integrated by a single control system, adding to the efficiency of the system.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is estimated to be P10,185,000 including the purchase and installation of a new washing system, import shipping fees, and a 5% contingency factor. The cost of the project will be funded by TTEM, P4,700,000 (46%), another loan of P5,300,000 (52%), and KSLI resources of P185,000 (2%). The expected payback period and IRR were calculated to be approximately 2.8 years and 34%, respectively. This was attractive to KSLI, in comparison to the TTEM interest rate of 17%, and the market rate of 25% to 30%.

Expected Energy and Monetary Savings

The project is expected to save 266,300 liters of bunker oil, 2995.5 MT of wood, and 275,150 KWH per year. This is equivalent to 6320 BOE per year, which represents the total energy consumption of the two boilers which supply hot water to the system, plus the energy used by the new washing equipment. The total monetary savings are expected to be P 3,642,200 annually.

National Impact

There are several laundry facilities in the Philippines which could implement this system. Replication of this technology by even a few industrial plants using steam systems would have a large impact on reducing energy consumption. The short payback and excellent IRR offer good incentive for implementing similar projects.

20. SUPER PLYWOOD CORPORATION

Company Background and Financial Standing

Super Plywood Corporation (SUPERPLY) was established as a private Filipino investor-owned business in 1986. The company manufactures, buys and sells logs, lumber, veneer, plywood and other wood products. The company's plywood processing plant is located in Maco, Davao del Norte, and its main headquarters are located in Bajada, Davao City. In 1989, the company used 32,000 m^3 coconut husk and 15,000 m^3 wood waste (generated internally) to produce plywood.

Super Plywood is a fairly new company. Therefore, at the end of 1988 it still had a high debt to equity ratio of 15. By the end of 1989, the company had reduced this ratio to 5.45, showing good economic growth. As of year end 1989, it had P34.7 million in total assets and P5.4 million in stockholders' equity. Due to SUPERPLY's good credit rating it was able to arrange credit for this project.

Project Description

SUPERPLY's project is being undertaken to improve the steam system within its plywood plant. The following is being implemented in order to achieve improved energy efficiency:

1. Modification/improvement of the steam trapping system for the veneer dryers and hot press.

2. Installation of condensate receivers and pumps for the reuse of flash steam in the dryer and pumping the condensate to the condensate tank.

3. Installation of automatic air vent at the terminal ends of veneer dryers and hot press.

4. Installation of pressure reducing station to automatically control steam pressure for the hot press.

5. Realignment of steam line to shorten the length of travel of steam.

6. Insulation of steam lines.

7. Improvement of air circulation in boiler combustion chamber, to improve combustion efficiency.

Status: The project is in its final stages of construction and is expected to be completed in December 1990. Performance monitoring and a case study report will be completed in 1991.

Project Cost and Economic Assessment

The total cost of this project is estimated to be P3,525,400 including the design and engineering (P200,000), equipment (P2,504,100) and installation (P500,800) and a 10% contingency factor. The cost of the project will be funded by TTEM and SUPERPLY, at P 2.6 million (74%) and P 0.93 million (26%), respectively. The expected payback period and IRR are approximately 2.6 years and 36%, respectively. This is very attractive to SUPERPLY, in comparison to the calculated TTEM interest rate of about 17%, and the commercial market rates which were between 26% to 30% at the time of project implementation.

Expected Energy and Monetary Savings

The project is expected to save 28,650 m^3 (2915 MT) coconut husk per year, which is equivalent to 4081 BOE per year. The monetary savings from purchasing reduced

quantities of coconut husk is expected to be P1,338,300. The savings achieved for each component of the project are: 1) Boiler combustion chamber improvement - P177,500; 2) Condensate recovery - P252,700; 3) Repair of leaking steam traps - P193,900; 4) Repair of steam leaks - P82,200; 4) flash steam recovery - P316,450; and 5) Insulation system -P315,450.

National Impact

The TTEM Project Paper estimated that more than 900 plants in the Manila area which could improve the efficiency of their steam systems. The quick payback and very favorable IRR are good incentive for other firms to implement this type of project.

APPENDIX E

PROJECT OUTREACH AND INFORMATION DISSEMINATION

APPENDIX E: PROJECT OUTREACH AND INFORMATION DISSEMINATION

1987

Seminars

1. *Basic Energy Management Training Course*, UP-NEC, A. Evans, May 4, 1987.
2. *Technology and Risk Assessment and Management Program*, UP-NEC, A. Evans, July 25, 1987.
3. *Powerplant Design, Operation, and Maintenance Course*, UP-NEC/UNIDO, A. Evans and W. Liegois, November 20, 1987.
4. *Waste Heat Recovery*, UP-NEC, W. Liegois, November 24, 1987.
5. *Combustion Controls*, UP-NEC, S. Warner, November 25, 1987.
6. *ENMAP Annual Meeting*, W. Liegois and S. Warner, Manila Garden, December 1-4, 1987.

Exhibits

1. *Department of Energy, Environment, and Natural Resources Anniversary Exhibition*, Quezon City, May 15-17, 1987.
2. *Metal Wood '87, Second International Metalworking and Woodworking Equipment Show*, Philcite, Sept 22-26, 1987.
3. *OEA/NCRD Conference on Nonconventional Energy Technologies*, Manila Hilton, Sept. 29-30, 1987.
4. *ENMAP Annual Meeting*, Manila Garden, December 1-4, 1987.

Presentations

1. *ENMAP Quarterly Meeting*, A. Evans, March 14, 1987.
2. *TTEM Working Group Meeting*, with ENMAP, A. Evans, April 10, 1987.
3. Philippine Chamber of Commerce and Industry, Committee on Industry, A. Evans, April 23, 1987.
4. OEA/Nonconventional Resources Division, A. Evans, May 8, 1987.
5. Philippine Society of Mechanical Engineers, A. Evans, May 30, 1987.
6. *Implementor's Meeting*, OEA/Nonconventional Energy Resources Division, A. Evans, July 23, 1987.
7. Manila Stanford Club, A. Evans, August 26, 1987.
8. *OEA/Conference on Nonconventional Energy Technologies*, A. Evans, Sept 30, 1987.

9. *ENMAP Annual Meeting*, A. Evans, December 1-4, 1987.

1988

TTEM Publications

A. Project Newsletter

TTEM Channel, Volume 1, Number 1, January 1988
Number 2, March 1988
Number 3, May 1988
Number 4, September 1988

B. Seminar Proceedings

1. *Waste Heat Recovery Systems and Applications*, ENMAP (TTEM co-sponsored with UNIDO), Manila Garden Hotel, February 17-19, 1988.
2. *Financing Energy Conservation Projects*, ENMAP and in cooperation with Financial Executives Institute of the Philippines, Manila Garden Hotel, June 23, 1988.

Seminars

1. *Waste Heat Recovery Systems and Applications*, ENMAP (TTEM co-sponsored with UNIDO), A. Evans, C. Jayco, and J. Garcia, Manila Garden Hotel, February 17-19, 1988.
2. *TTEM Orientation Seminar*, Bankers Association of the Philippines (BAP), A. Evans, C. Jayco, and J. Garcia, BAP headquarters, Makati, March 24, 1988.
3. *Building Energy Management Systems*, with UP-NEC, J. Austgen, A. Evans, and J. Garcia, UP-NEC Building, April 14, 1988.
4. *TTEM Orientation Seminar*, to Samahang Pilipino ng Industriynag Kimika (SPIK, the Chemical Industries of the Philippines), A. Evans, C. Jayco, and J. Garcia, Manila Peninsula Hotel, April 27, 1988.
5. *Financing Energy Conservation Projects*, with ENMAP and in cooperation with Financial Executives Institute of the Philippines, A. Evans and J. Garcia, Manila Garden Hotel, June 23, 1988.
6. *Private Power Generation through Build-Operate-Transfer*, with OEA Planning Services, Philippine Chamber of Commerce and Industry, and USAID, Office of Energy (Washington), Manila Hilton, October 5-6, 1988.

92

7. *Industrial Controls Technology*, World Bank TAC SAL II Project, Workshop for the Food Processing and Coconut Oil Industries, Part 1, PNOC-ERDC, S. Warner, Quezon City, November 11, 1988.
8. *TTEM Orientation Seminar*, with Cebu Chamber of Commerce and Industry, A. Evans, S. Warner and TTEM Senior Staff, Casino Espanol de Cebu, November 16, 1988.
9. *Industrial Cogeneration*, World Bank TAC SAL II Project, Workshop for the Food Processing and Coconut Oil Industries, Part 2, PNOC-ERDC, W. Smith, Quezon City, December 1, 1988.
10. *Energy Technology Conference*, with ENMAP and other co-sponsors, W. Smith, A. Evans and J. Garcia, Manila Garden Hotel, December 6-8, 1988.
11. *Cogeneration Seminar*, OEA Planning Services, W. Smith, OEA Building, Makati, December 16, 1988.

Exhibits

1. *ENMAP Annual Meeting*, Manila Garden Hotel, December 5-9, 1988.

Presentations

1. *Energy Conservation Project Financing*, OEA training seminar on *Industrial Energy Audits*, J. Garcia, Cebu, July 26, 1988.
2. *Technologies for Energy Conservation*, Hotel and Restaurant Association of the Philippines and Hotel Engineers Association of the Philippines, M. Semira, Manila, September 1988.
3. *Financial Evaluation of Enercon Projects*, World Bank TAC SAL II Project, Workshop for the Steel and Metals Industries, PNOC-ERDC, J. Garcia, Quezon City, September 20, 1988.
4. *TTEM Project Overview*, OEA training course on Building Energy Conservation, UP-NEC, A. Evans, September 1988.
5. *Financial Evaluation of Enercon Projects*, World Bank TAC SAL II Project, Workshop for the Steel and Metals Industries, PNOC-ERDC, J. Garcia, Quezon City, October 14, 1988.
6. *Workshop for the Cement and Mining Industries*, World Bank TAC SAL II Project, , PNOC-ERDC, A. Evans, Quezon City, October 14, 1988.
7. *TTEM Project Overview*, OEA training course on Efficient Steam Generation and Utilization, M. Semira, Iloilo City, November 23, 1988.
8. *Enercon Financing and the TTEM Project*, World Bank TAC SAL II Project, Workshop for the Food Processing and Coconut Oil Industries, Part 2, PNOC-ERDC, A. Evans, Quezon City, December 2, 1988.

Audio-Visual Presentation

Narrated slide show (15 minutes), shown to various groups

1989

TTEM Publications

A. Project Newsletter

TTEM Channel, Volume 1, Number 5, January 1989
Number 6, March 1989
Number 7, May 1989
Number 8, September 1989

B. Seminar Proceedings

1. *Cogeneration Technology Course*, with ENMAP and OEA, Manila Garden Hotel, June 13-17, 1989.

Seminars

1. *Energy Conservation as a New Energy Source*, ASEAN Science and Technology Week, A. Evans, February 1-2, 1989.
2. *Cogeneration Seminar*, TTEM/ENMAP, Manila Garden Hotel, June 13-17, 1989.
3. *Davao TTEM Orientation Seminar*, Davao City Chamber of Commerce and Industry, Members of the TTEM Staff, M. Ellis and R. Erickson, Davao City, June 28, 1989.
4. *Cagayan de Oro TTEM Orientation Seminar*, Cagayan de Oro Chamber of Commerce and Industry, Members of TTEM Staff and M. Ellis, Cagayan de Oro, August 1989.
5. Seminar for account managers at PDCP on the TTEM DLF Guidelines, August, 1989.
6. *US-ASEAN Center for Technology Exchange Trade Show*, November 1989.

Presentations

1. *Private Power Hearing*, R. Custodio, R. San Diego and A. Evans, MERALCO, February 15, 1989.
2. USAID Staff on progress made by TTEM towards meeting project benchmarks.
3. Philippine Society of Mechanical Engineers, June 10, 1989.
4. *UNDP ZOPP Planning Session*, J. Garcia and M. Ellis.
5. Mr. Robert Archer, USAID-Washington on TTEM project goals and accomplishments, October 1989.

Audio-Visual Presentation

Narrated slide show (15 minutes), shown to various groups (Revised in 1989)

1990

TTEM Publications

A. Project Newsletter

TTEM Channel, Volume 1, Number 9, March 1990
Number 10, June 1990

Seminars

1. *PFI Orientation Seminar*, March 1990.
2. *Building Energy Management Systems*, with ENMAP, Members of the TTEM Staff, M. Ellis and R. Panke, Manila Garden Hotel, May 7-11, 1990.
3. *Economic and Financial Evaluation of Energy Conservation Projects*, with ENMAP, November 1990.

Exhibits

1. *Energy Week*, Philippine Chamber of Commerce and Industry, January 1990.
2. *Civil Service Week*, OEA, September 1990.

Presentations

1. *Seminar on Energy Conservation Technologies*, Philippine Society of Mechanical Engineers, M. Ellis, Manila, May 5, 1990.

APPENDIX F
TTEM STAFF TRAINING

APPENDIX F: TTEM STAFF TRAINING

A. TRAINING IN THE U.S.

1989

1. J. Garcia, TTEM, and J. Anunciacion, OEA, attended a three-week training program in Project Management, July 19 - August 9, 1989.
2. M. Semira, TTEM, and A. Habitan, OEA, attended a four-week training program in Cogeneration, October 13 - November 14, 1989.
3. M. Marquez, TTEM, and P. Ruiz, OEA, attended a four-week training program in Building Energy Management Systems, November 8 - December 9, 1989.
4. C. Tablante, OEA, N. Franco, OEA, and M. Campanano, OEA, attended a three-day program on Industrial Energy Use Standards,

1990

1. R. San Diego, TTEM, and M. Briones, OEA, attended a four-week program on Industrial Process Controls, January 10 - February 15, 1990.
2. E. Pura, OEA, attended a six-week program on Project Analysis by A.D. Little, May 22 - July 6, 1990.
3. R. Amper, PLDT, and B. Marasigan, PLDT, attended a two-week program on Cogeneration Project Development, September 24 - October 6, 1990.

B. TRAINING IN THE PHILIPPINES

1987

1. M. Marquez attended a three-day course on "Preventive Maintenance of Motors and Electrical Equipment" at UP-NEC.
2. R. San Diego and E. Fernandez attended a seminar on "Reliability: A Tool for Efficient Plant and Facility Engineering and Management" held at UP-NEC, July 8 - August 14, 1987.
3. R. Villanueva attended an OEA-sponsored training on "Editing the Small Company's Newsletter" at the Ateneo Graduate School.
4. M. Marquez attended a two-day seminar on "Gasifier" at UP-NEC.
5. M. Marquez attended a seminar on "Industrial Process Control" at UP-NEC, September 16 - October 7, 1987.
6. M. Marquez and E. Fernandez attended a three-day seminar on "Efficient Boiler Operation" at UP-NEC.

7. M. Marquez attended a seminar on "Design, Efficient Operation and Maintenance of Air-Conditioning and Refrigeration System" at UP-NEC.
8. R. San Diego and M. Marquez attended a one-day seminar on "Combustion Monitoring and Control" at UP-NEC.

1988

1. J. Roa attended a one-day seminar on "Harvard Total Project Management: Concept and Application" at Dataworld Computer.
2. M. Marquez and R. San Diego attended a three-day seminar on "Optimization of Heat Exchanger Networks" at UP-NEC.
3. E. Labos attended a five-day seminar on "Energy Audit for Buildings" at UP-NEC.

1989

1. J. Cheng attended a four-day seminar on "Industrial Energy Audit" at UP-NEC.
2. E. Labos and V. O'Dell attended a seminar on "Building Energy Management" at UP-NEC.
3. J. Buenavente, A. Bacolcol and L. Anasarias attended a three-day course sponsored by OEA on "Energy Conservation in Air-Conditioned Systems".
4. L. Anasarias and A. Bacolcol attended a five-day seminar on "Cogeneration" at Manila Garden Hotel.
5. E. Labos, J. Cheng, A. Bacolcol, L. Anasarias, J. Roa and V. O'Dell attended the seminar "Technical Report Writing" at the Development Academy of the Philippines.
6. L. Anasarias attended the two-day seminar on "Combustion Monitoring" at Manila Garden Hotel.
7. R. Gaspar attended the seminar "News and Feature Writing" at the Development Academy of the Philippines.

1990

1. J. Cheng and V. O'Dell attended a five-day seminar on "Basic Energy Management Training" at UP-NEC.
2. J. Roa and E. Labos attended a three-day seminar on "Timeline" at the Manila Peninsula.
3. A. Bacolcol and E. Labos attended a five-day seminar on "Building Energy Management" at Manila Garden Hotel.

APPENDIX G
RMA AND CONTRACTOR REPORTS

APPENDIX G: RMA AND CONTRACTOR REPORTS

RMA Annual Reports - Series RMA/GOP-AR

1. "First Annual Report", RMA/GOP-AR-1, January 1988.
2. "Second Annual Report", RMA/GOP-AR-2, December 1988.
3. "Third Annual Report", RMA/GOP-AR-3, January 1990.

RMA Special Reports

1. "Study of the Options for Institutionalization of the Technology Transfer for Energy Management Project in the Philippines", Resource Management Associates, April 30, 1990.
2. "Energy Conservation Policy Options for the Philippines", November 1990.
3. "Final Report", November 1990.
4. "Energy Conserving Equipment Manufacturer's Directory", April 14, 1989.

RMA Monthly Project Reports

MR-1 (March 1987) through MR-46 (December 1990).

RMA Trip Reports - Series RMA/GOP-TD

1. "Technology Transfer for Energy Management Project Demonstration Loan Fund", RMA/GOP-TD-1, June 29, 1987.
2. "Industrial Sector Energy Use Data Consolidation and Analysis", RMA/GOP-TD-2, July 10, 1987.
3. "Technology Transfer for Energy Management Project Demonstration Loan Fund", RMA/GOP-TD-3, September 30, 1987.
4. "Industrial Energy Use and Targets: Analysis and Modelling", RMA/GOP-TD-4, November 4, 1987.
5. "TTEM Training in Waste Heat Recovery and Combustion Monitoring and Control", RMA/GOP-TD-5, January 1988.
6. "TTEM Training in Building Energy Management", RMA/GOP-TD-6, May 1988.
7. "TTEM Field Support and Training in Insulation", RMA/GOP-TD-7, October 1988.
8. "TTEM Training in Industrial Controls", RMA/GOP-TD-8, January 1989.
9. "TTEM Training in Cogeneration", RMA/GOP-TD-9, February 1989.
10. "TTEM Field Support in Cogeneration", RMA/GOP-TD-10A, July 1989.

11. "TTEM Field Support in Cogeneration", RMA/GOP-TD-10B, August 1989.
12. "PLDT Cogeneration Project Development: Phase I", RMA/GOP-TD-11, May 1990.
13. "TTEM Field Support and Training in Building Energy Management Systems (BEMS):, RMA/GOP-TD-12, August 1990.
14. "PLDT Cogeneration Project Development: Phase II", RMA/GOP-TD-13, August 1990.
15. "PLDT Cogeneration Project Development: Final Report", RMA/GOP-TD-14, December 1990.

RMA Technical Information Notebooks - Series RMA/GOP-TIN

1. "Heat Exchangers/Heat Recovery - Manufacturer's Information", October 27, 1987, Report RMA/GOP-TIN-1A.
2. "Heat Exchange/Heat Recovery - Manufacturer's Information Diversified Industrial Products, Inc.", October 27, 1987, Report RMA/GOP-TIN-1B.
3. "Heat Exchange/Heat Recovery - Manufacturer's Information Des Champs Laboratories, Inc.", October 27, 1987, Report RMA/GOP-TIN-1C.
4. "Heat Exchange/Heat Recovery - Manufacturer's Information General Resources Corporation", October 27, 1987, Report RMA/GOP-TIN-1D.
5. "Heat Exchangers/Heat Recovery - Journal Articles", November 13, 1987, Report RMA/GOP-TIN-1E.
6. "Heat Exchangers/Heat Recovery - Manufacturer's Information Exothermics-Eclipse, Inc.", December 9, 1987, Report RMA/GOP-TIN-1F.
7. "Combustion Controls - Manufacturer's Information", December 9, 1987, Report RMA/GOP-TIN-2A.
8. "Combustion Controls - Journal Articles", December 18, 1987, Report RMA/GOP-TIN-2B.
9. "Building Energy Management Systems - Manufacturer's Information", RMA/GOP-TIN-3A, February 4, 1988.
10. "Building Energy Management Systems - Manufacturer's Information, Andover Controls Corporation", RMA/GOP-TIN-3B, February 4, 1988.
11. "Building Energy Management Systems -Manufacturer's Information, Voltec, Inc.", RMA/GOP-TIN-3C, February 4, 1988.
12. "Building Energy Management Systems - Journal Articles", RMA/GOP-TIN-3D, February 4, 1988.
13. "Cogeneration Systems - Journal Articles", RMA/GOP-TIN-4A, April 20, 1988.
14. "Steam Systems - Manufacturer's Information", RMA/GOP-TIN-5A, June 17, 1988.
15. "Steam Systems - Manufacturer's Information, Stickle Steam Specialties Co., Inc.", RMA/GOP-TIN-5B, June 17, 1988.
16. "Steam Systems - Journal Articles", RMA/GOP-TIN-5C, June 17, 1988.

17. "Steam Systems - Manufacturer's Information, Watson McDaniel Co.", RMA/GOP-TIN-5D, June 17, 1988.
18. "Steam Systems - Manufacturer's Information, Hoffman ITT Corp.", RMA/GOP-TIN-5E, June 17, 1988.
19. "Steam Systems - Manufacturer's Information, Barnes and Jones", RMA/GOP-TIN-5F, June 17, 1988.
20. "Lighting - Manufacturer's Information", RMA/GOP-TIN-6A, June 1988.
21. "Lighting - Manufacturer's Information, Guth Lighting Solutions", RMA/GOP-TIN-6B, June 1988.
22. "Lighting - Manufacturer's Information, Prescolite Architectural Lighting", RMA/GOP-TIN-6C, June 1988.
23. "Lighting - Journal Articles", RMA/GOP-TIN-6D, June 1988.

Quick Response Tasks - Series RMA/GOP-QRT

1. "Controls for Exhaust Pressure of a Diesel Cogeneration Unit", RMA/GOP-QRT-1, March 1988.
2. "Philippine Aluminum Wheels, Inc., Waste Heat Recovery from Exhaust Gas of Crucible", RMA/GOP-QRT-2, May 1988.
3. "Philippine Aluminum Wheels, Inc., Aluminum Melting Furnace Project", RMA/GOP-QRT-3, May 1988.
4. "Preliminary Review of the National Power Corporation Rules and Regulations on Private Sector Power Generation", RMA/GOP-QRT-4, September 9, 1988.
5. "Enercon Equipment Costs", RMA/GOP-QRT-5, February 1989.
6. "Preliminary Feasibility Analysis for Bacnotan Consolidated Industries La Union Plant Automated Control System", RMA/GOP-QRT-6, August 1989.

Technical Applications - Series RMA/GOP-ECM

1. "Energy Management Systems", RMA/GOP-ECM-1, September 29, 1988.
2. "Lighting Systems", RMA/GOP-ECM-2, September 21, 1988.
3. "Combustion/Trim Control Systems", RMA/GOP-ECM-3, January 10, 1989.
4. "Steam System Improvements", RMA/GOP-ECM-4, February 15, 1989.
5. "Variable Speed Drives", RMA/GOP-ECM-5, June 15, 1989.
6. "Chiller Controls", RMA/GOP-ECM-6, February 1990.
7. "Absorption Chillers", RMA/GOP-ECM-7, March 21, 1990
8. "Thermal Storage", RMA/GOP-ECM-8, March 21, 1990.

Training Trip Reports - Series RMA/GOP-TR

1. "Report of U.S. Training Trip: Executive Training in Project Management", Jose Garcia and Jesus Anunciacion, RMA/GOP-TR-1, July 19-August 9, 1989
2. "Report of U.S. Training Trip: Technical Training in Cogeneration", Marcial Semira and Artemio Habitan, RMA/GOP-TR-2, October 13-November 14, 1989.
3. "Report of U.S. Training Trip: Technical Training in BEMS/HVAC Systems", Peal Martin Ruiz and Maximino Marquez, RMA/GOP-TR-3, November 8-December 9, 1989.
4. "Report of U.S. Training Trip: Technical Training in Industrial Process Controls", Ruth San Diego and Mario Briones, RMA/GOP-TR-4, January 10 - February 15, 1990.
5. "Report of U.S. Training Trip: Training in Project Analysis", Esther Pura, RMA/GOP-TR-5, May 22 - July 6, 1990.

Project/Subproject Technical Evaluations

1. "Evaluation of Building Automation System Proposal, by Electro-Systems, 31 May 1989, for Lopez Building of Meralco", R. Panke, July 25, 1990.
2. "Proposal for Cogeneration Facilities for Private Power and Absorption Chilling", engineering proposal evaluation for the Westin Philippine Plaza Hotel, Michael Ellis, July 1990.
3. "Proposal for B-O-T Cogeneration Facilities", B-O-T proposal evaluation for Sime Darby (Phils), Michael Ellis, September 1990.
4. Commissioning of Steam Turbine Generator", engineering and private power evaluation for Super Plywood, Michael Ellis, September 1990.
5. "Evaluation of Building Automation System Proposal, by Electro-Systems, 5 October 1988, for MGO and RUC Buildings of Philippine Long Distance Telephone Co.", Richard Panke, September 1, 1990.
6. "Evaluation of Building Automation System Proposal, by Unitech Engineering Corporation, 27 June 1989, for Bank of the Philippine Islands - Main Office Building", Richard Panke, September 1990.

Price Waterhouse Work Order Reports (under subcontract to RMA)

1. "TTEM Senior Staffing Options", July 22, 1987.
2. "Study of Proposed Lending Policy to Govern the TTEM-Demonstration Loan Fund" and lecture series on these issues, August 17, 1987.

APPENDIX H
TECHNICAL ASSISTANCE PROVIDED BY TTEM

APPENDIX H: TECHNICAL ASSISTANCE PROVIDED BY TTEM

1988

1.	Benguet Building	U.S. Consultant Services (Austgen)
2.	PLDT Building	"
3.	Manila Garden	"
4.	RCBC Building	"
5.	Royal Porcelain	U.S. Consultant Services (Warner)
6.	Sime Darby	"
7.	Jacinto Iron & Steel Corp.	"
8.	Ramcar, Inc.	"
9.	Virginia Farms, Inc.	"
10.	Royal Metal, Inc.	"
11.	Mackie Industries/ Shemberg	"
12.	Cebu Plaza	"
13.	Phinma Corp.	U.S. Consultant Services (Dries)
14.	Magnolia Daisy Products	"
15.	Polyphosphates	U.S. Consultant Services/Technical Evaluation (Dries)
16.	RCBC Building	U.S. Consultant Services (Dries)
17.	Johnson & Johnson (Phil), Inc.	"
18.	CADP	"
19.	PLDT	U.S. Consultant Services (Smith)
20.	Sime Darby	"
21.	Papermaking Industries Corp. of the Philippines	"
22.	UGCC	"
23.	SMC	"
24.	PAWI	Technical Information/Energy Audit
25.	La Tondena	"
26.	Reynolds Aluminum	Energy Audit
27.	COACO	"
28.	Nobel Phil.	"
29.	Wrigley	"
30.	Holiday Inn	"
31.	Cenapro Chemical Corp.	Technical Information
32.	Jollibee Food Corp.	Technical Information/Project Evaluation
33.	Filsyn Corp.	"
34.	Fil-Hispano	U.S. Consultant Services (Warner/Liegois)
35.	AMAC	"
36.	Visayan Glass Factory	Technical Information
37.	International Pharmaceutical, Inc.	Technical Information

38.	Magellan Hotel	"
39.	Central Textile Mills	"
40.	J & P Coats Manila Bay, Inc.	"
41.	Sunpride Food, Inc.	"
42.	Colgate Palmolive Phils.	Energy Audit

1989

1.	Aras-Asan Timber Co.	Energy Audit
2.	Bacnotan Consolidated	Preliminary Study - Plant Automation
3.	Bell Carpets	Preliminary Study - Cogeneration
4.	Cebu Plaza Hotel	Energy Audit
5.	Coca-Cola (Cagayan de Oro)	Special Study - Cogeneration
6.	Diamond Knitting Corp.	Energy Audit
7.	Food Terminal Inc.	U.S. Consultant Services (Smith/Erickson)
8.	Fortune Net & Twine	Energy Audit
9.	Franklin Baker (Davao)	Special Study - Waste Heat Recovery
10.	Goodyear Phils.	U.S. Consultant Services (Smith)
11.	Insular Canning Corp.	Preliminary Study - Condensate Recovery
12.	Johnson & Johnson Phils.	U.S. Consultant Services (Smith/Erickson)
13.	Kimberly Clark	"
14.	Kings Mills	Energy Audit
15.	Lyon Textile Mills	"
16.	Mandarin Oriental Hotel	U.S. Consultant Services (Smith/Erickson)
17.	Manila Hotel	"
18.	Papermaking Industries Corp. of the Philippines	U.S Consultant Services (Smith)
19.	PLDT	U.S. Consultant Services (Smith/Erickson)
20.	Philippine Plaza Hotel	"
21.	Pryce Gasses - Cagayan de Oro	Preliminary Study - Power Factor
22.	Saniwares	U.S. Consultant Services (Smith/Erickson)
23.	Seamark Enterprises	Energy Audit
24.	Union Glass & Container Corp.	Furnace Efficiency Testing
25.	United Pulp Paper Corp.	U.S. Consultant Services (Smith)
26.	Alcantara & Sons, Inc.	"

1990

1.	Clothman Knitting	Energy Audit
2.	Liberty Paper, Inc.	Energy Audit/Cogeneration Study
3.	Saniwares	Cogeneration Study
4.	Century Canning	Insulation Study
5.	Unisol	Energy Audit

6.	Diamond Knitting	Dryer Energy Audit
7.	TIPCO	Information
8.	Mabuhay Vinyl Corp.	U.S. Consultant Services (Panke)
9.	San Miguel Corp.	"
10.	Makati Medical Center	"
11.	BPI	"
12.	PLDT	"
13.	Manila Peninsula Hotel	"
14.	Westin Philippine Plaza	"
15.	MERALCO	"
16.	DBP	"
17.	Alcantara & Sons	Energy Audit
18.	Hyatt Regency Hotel	Information
19.	Super Plywood	Energy Audit
20.	Philippine Plaza	U.S. Consultant Services (Ellis)
21.	Sime Darby	"
22.	Super Plywood	"
23.	Cebu Plaza	"
24.	Liberty Paper	"
25.	PLDT Cogeneration Study	U.S. Consultant Services (Erickson)
26.	Bell Carpets	Equipment Search

APPENDIX I
SHORT-TERM CONSULTANT TRIPS

APPENDIX I: SHORT-TERM CONSULTANT TRIPS

1987

1. Consultant: Mr. Charles Fafard
   Dates: May 11-26
   Trip Objectives: Meet with TTEM staff, private and public sector representatives and with professional consultants to identify the most appropriate technologies for the project, and to ascertain levels of interest in these technologies and the TTEM project.

2. Consultant: Mr. Robert Lopez
   Dates: May 11-26
   Trip Objectives: Work with TTEM staff to identify, locate and structure data on industrial energy utilization for use in evaluating conservation impacts and replicability of the DLF technologies. Provide training for the TTEM staff in computer and database skills.

3. Consultant: Mr. Michael Roelofs
   Dates: August 9 - September 4
   Trip Objectives: Finalize the DLF application procedure and form, selection criteria, and publicity materials for applicants and participating financial institutions, and establish a timetable for TTEM activities.

4. Consultant: Dr. Malcolm Lindsay
   Dates: September 28 - October 10
   Trip Objectives: Develop and implement a computer model to quantify potential conservation impacts of the technologies, and train the TTEM staff in its use.

5. Consultant: Mr. William Liegois
   Dates: November 14 - December 4
   Trip Objectives: Train TTEM staff in waste heat recovery technologies. Secondary objectives included marketing the TTEM program at the annual ENMAP meeting, and technical training for potential applicants.

6. Consultant: Mr. Steven Warner
   Dates: November 14 - December 4
   Trip Objectives: Scheduled concurrently with Mr. Liegois' trip, to provide training for the TTEM staff in combustion control techniques and in the evaluation of DLF proposals in this technology.

110

1988

1. Consultant: Dr. Wesley K. Foell
   Dates: February 15 - 20, 1988
   Trip Objectives: Discuss project status with OEA and USAID; plan for 1988 with TTEM staff.

2. Consultant: Mr. John Austgen
   Date: April 9 - April 30
   Trip Objectives: Train TTEM staff in building energy management systems. Secondary objectives included conducting marketing calls with the TTEM staff to potential clients and feasibility analysis of projects.

3. Consultant: Dr. William Dries
   Dates: August 5 - September 3
   Trip Objectives: Train TTEM staff on the fundamentals of insulation, assist in processing and evaluating applications and designs for funding; work with the TTEM staff to identify local consultants.

4. Consultant: Mr. Steven Warner
   Dates: October 30 - November 22
   Trip Objectives: Train TTEM staff in industrial controls technology. Secondary objectives included review of TTEM proposals on industrial controls projects; work with applicants and prospective applicants on design tasks, visit sites to review potential projects; and meet with Philippine vendors to pursue their participation in TTEM.

5. Consultant: Mr. Walter Smith
   Dates: November 25 - December 17
   Objectives: Provide training to TTEM staff in cogeneration. Secondary objectives included identification of potential DLF participants, and presentations on cogeneration technology at the annual ENMAP meeting.

1989

1. Consultant: Mr. Walter Smith
   Dates: June 2 - June 21
   Trip Objectives: Develop and instruct an in-depth course in cogeneration for professionals from the industrial, commercial and utility sectors. The major focus was on the small cogeneration market. A secondary objective was a

111

focus was on the small cogeneration market. A secondary objective was a feasibility study of a commercial site for cogeneration.

2. Consultant: Mr. Robert Erickson
   Dates: June 3 - July 7
   Trip Objectives: Conduct feasibility study for cogeneration in two sites: one commercial and one industrial; instruct the cogeneration course with Mr. Walt Smith; and identify other potential DLF applicants through site visits.

3. Consultant: Dr. Wesley Foell
   Dates: November 27 - December 1, 1989
   Trip Objectives: Discuss project status with OEA and USAID; plan for 1990 with TTEM Staff.

1990

1. Consultant: Mr. Orson Kellogg
   Dates: January 29 - 31
   Trip Objectives: Provide intensive training to OEA and TTEM staff in project management using Timeline software.

2. Consultants: Mr. Michael Roelofs, Ms. Diane Hennessey
   Date: February 2 - 16
   Trip Objectives: Conduct study to explore the options for institutionalization of the TTEM Project, following USAID assistance; evaluate current status of TTEM; make recommendations for institutional options.

3. Consultant: Mr. Richard Panke
   Dates: May 5 - 24
   Trip Objectives: Develop and teach a 5-day course on building energy management systems and conduct site visits to identify potential BEMS applications.

4. Consultants: Mr Martin Allen, Mr Amar Cheema
   Dates: May 2 - 9
   Trip Objectives: Conduct a two day intensive course on energy management systems for OEA, and for Philippine energy managers as part of the 5-day BEMS seminar.

5. Consultant: Mr. Robert Erickson
Dates: Phase I - March 20 - April 12
Phase II - June 13 - July 3
Phase III - October 22 - November 9
Trip Objectives: Conduct an in-depth feasibility study and design of a demonstration cogeneration system for switching centers for the Philippines Long Distance Telephone Company.

APPENDIX J
COMMODITY PROCUREMENTS

APPENDIX J: COMMODITY PROCUREMENT

A. Project Vehicle

1. 1987 Dodge B-150 Van
2. Rustproofing
3. Miscellaneous replacement parts. A complete list is available from the Technical Assistance Contractor.

B. Energy Audit Equipment

1. (2) Volt/Ohm Amp Meter
2. (2) Gas Burner Kit
3. (4) Cartons CO2 Fluid
4. (4) Cartons O2 Fluid
5. (5) Cartons CO Tubes
6. (2) Sling Psychrometer
7. (1) Watt Probe
8. (200 ft.) Tcouple Wire Type K14 Gauge
9. (200 ft.) Tcouple Wire Type K16 Gauge
10. (2) Fuse
11. (2) Probe
12. (1) Non-Contact Infrared Thermometer
13. (2) Interchangeable Jaw
14. (2) Alligator Clip Probe
15. (8) Thermometer
16. (2) Fused Probe
17. (8) Wick Replacement Kit
18. (1) Velometer
19. (2) Multi-Purpose Pyrometer
20. (1) Duplex Kit - Gas Analyzer
21. Industrial Safety Equipment
22. Stripchart Recorder with Control Panel
23. (25) Stripchart Recorder Paper Rolls
24. Power Meter/Printer
25. Three Phase Kit
26. Thermal Paper
27. Pocket Combustion Efficiency Analyzer
28. 24" Probe
29. Light Meter: Digital, Built-in Sensor
30. Attache Case

31. TIF Power Factor Meter
32. 2" Jaw, Model
33. Anonmeter
34. Vane Probe for 4000
35. Humidity Probe
36. Telescope for 4500.10
37. Service Case
38. Paper for Recorder
39. Recorder
40. Thermo Couple Probe Assy Type K 24"
41. Thermo Couple Probe Assy Type K 24"
42. Hewlett Packard HP42S Scientific (4 units)
43. Hewlett Packard Quick Reference Card (5 units)
44. Hewlett Packard HP-12C Financial (2 units)
45. Flow computer w/Graphics Display
46. Touch-on/Clamp-on Double-Head Transducer
47. Cable Assembly, 8"
48. Portable Carrying Case
49. Power Adapter/Battery Charger
50. Portable Thermal Printer
51. Printer Paper
52. (4) Vaneometer, carrying case, air meter
53. Triad
54. Matrix Processor
55. Environmental Module
56. Deluxe Cas; MPM 4000, 5 probes
57. Stainless steel bench stand
58. Output cable\1.5m
59. 110V charger for DC3, Log,AC adp.
60. K Thermocouple Air/Gas Probe
61. High Temp Surface Probe
62. Fast Res. Thermo-Hygro Probe.
63. Differential Air Pressure Probe
64. 220MP Pitot

C. Microcomputers and Accessories

1. (2) IBM PC-Compatibles
2. (2) Canon Printers
3. "Fisher Valve Sizing Program" for IBM DOS, Fisher Controls International, Inc., 1985.
4. "SIMTUNE Process Control Simulation Tuning and Training", CHC Systems

Engineering, Inc., 1987.
5. Timeline Software 3.0
6. Computer Equipment Upgrade (20 MB HardDrive, 360K Floppy Drive, 1 Cannon Printhead)
7. Envest Software
8. PC Cube Software
9. Miscellaneous computer supplies.

D. Technical Reference Books

1. HVAC Controls for Energy Conservation
2. Cogeneration, Fuels and Combustion
3. Energy Performance Analysis and Calculations
4. Thermal Storage
5. ASHRAE Handbook -- HVAC Systems and Applications
6. Energy Recovery Equipment and Systems Air-to-Air, Sheet Metal and Air Conditioning Contractors' National Association
7. Water Manual for Boiler Operation
8. Steam Efficiency Improvement
9. Energy Economics and Technology
10. Energy Management and Control Systems Handbook
11. Compressed Air Systems
12. ASHRAE Handbook: 1985 Fundamentals
13. Advanced Technologies: Improving Industrial Efficiency
14. Energy Engineering
15. The Cogeneration Sourcebook
16. Efficient Boiler Operations Sourcebook
17. Handbook of Energy Systems Engineering: Production and Utilization
18. Managerial Finance
19. 1987 Service Manual for Rear Wheel Drive Van
20. Pacific Gas & Electric Notes
21. Practical Process Engineering: A Working Approach to Plant Design
22. Control Systems for Air Conditioning and Refrigeration
23. Heating, Ventilating, and Air conditioning: Design for Building Construction
24. Industrial Process Control Systems
25. Power Generation calculations Reference Guide
26. The Energy Management Systems Sourcebook
27. (19) Useful Tables for Engineers and Steam Users
28. Strategies for Energy Efficient Plants and Intelligent Buildings
29. Boiler Water Requirements and Associated Steam Purity for Commercial Boilers
30. Boiler Water Limits and Steam Purity Recommendations for Watertube Boilers

31. Guidelines for Industrial Boiler Performance Improvement
32. Thermal Shock Damamge to Hot Water Boilers
33. Heat and Power Industry Brochure
34. Industrial and Commercial Cogeneration Case Studies
35. Reference Guide to Small Cogeneration Systems for Utilities
36. Boiler Efficiency Improvement
37. A Handbook for Industry-Sponsored Education Programs
38. Energy Management Systems for Commercial Buildings
39. Steam - Its Generation and Use
40. Energy Saving by Increasing Boiler Efficiency
41. Planning Cogeneration Systems
42. Cogeneration Technology and Economics for the Process Industries
43. GPSA Engineering Data Book
44. Cameron Hydraulic Data
45. The Flow of Fluids Through Valves, Fittings and Pipes
46. Water: The Universal Solvent
47. Uniform Building Code
48. NICA Manual
49. HVAC Contracting Book
50. Emerging Policy Issues in PURPA Implementation
51. Means Mechanical Engineering Data
52. Corporation Credit Guide
53. Philippine Company Profiles
54. Business Profiles 1987
55. Business Perspectives
56. Directory of American Companies Operating in the Philippines
57. Energy Equipment Cost Directory
58. Project Evaluation and Implementation
59. Innovative Approaches to Financing Energy Conservation Investments in Developing Countries
60. Accelerating Private Investment in Energy Conservation: Identification and Analysis of Key Barriers and Tools
61. Energy Standards Directory for the Process Industry
62. Handbook for Energy Audits
63. Construction Paperwork
64. Efficient Boiler Operations Sourcebook
65. The Cogeneration & Small Power Production Manual
66. Means Mechanical Cost Data 1990$61.95
67. Chemical Engineering Equipment Buyer's Guide
68. Engineering Handbook of Conversion Factors
69. Diesel & Gas Turbine Catalogue, Vol. 54, 1989
70. Performing a Lighting System Audit, National Lighting Bureau

71. Industrial Lighting Handbook
72. Solving the Puzzle of VDT Viewing Problems
73. Profiting from Lighting Modernization
74. Guide to Office Lighting & Productivity
75. Energy Conservation in Buildings, Proceedings of the 5th Asian School, AIT, Bangkok
76. Principals of Waste Heat Recovery
77. Miscellaneous computer reference books
78. Miscellaneous technical reference books

E. Journals

1. Energy - The International Journal: 1987, 1988, 1989
2. Energy Systems and Policy: 1987, 1988, 1989
3. Energy Engineering: 1987, 1988, 1989
4. The Journal of Energy and Development: 1987
5. Energy Journal: 1987
6. Alternative Sources of Energy: 1987, 1988
7. Energy User News: 1987, 1988, 1989
8. Computer Magazine: 1987
9. Strategic Planning and Management: 1988
10. Cogeneration Journal: 1988, 1989
11. Air Conditioning, Heating and Refrigeration News: 1988, 1989, 1990
12. Resource Recovery/Cogeneration World: 1988
13. Diesel and Gas Turbine: 1988
14. Engineer's Digest: 1988
15. Engineered Systems: 1988
16. Heating/Piping/Air Conditioning: 1988
17. Chemical Engineering: 1989
18. Cogeneration: 1989
19. Independent Energy: 1990

F. Office Equipment

Miscellaneous office equipment was purchased for the TTEM Project office.

APPENDIX K
EXCERPTS FROM RIG/A AUDIT REPORT

In the first quarter of 1990, the USAID Regional Inspector General's Office conducted an audit of the TTEM Project (Audit Report No. 2-492-90-09). Contained in this appendix are key excerpts from the audit. The major questions addressed in the audit are the following:

1. Will the TTEM Project results be sustained after USAID assistance to the project ends?

2. What are the project outputs to date, and will TTEM meet the objectives specified in the Project Paper?

3. Was a system established by USAID to monitor and report the project's progress and to ensure that GOP and private sector contributions were made available for project purposes?

The excerpts contained in this appendix (pages 4-11) address the auditor's findings on questions 1 and 2, since these are the areas discussed in the Final Report.

At the time the audit was done, the TTEM Project was in the process of addressing these areas as a part of ongoing project tasks. The question of sustained results was the focus of the institutionalization study and the subsequent institutionalization plan. At the conclusion of the project, all of the concerns of the audit report will have been adequately addressed. Please refer to the body of the report for specific TTEM actions in each of these areas.

Audit Findings

Will the project achieve its objectives?

The results of the audit indicate that the project will not achieve its objectives to promote and accelerate the adoption of efficient energy technologies and operational practices by industrial energy consumers and to establish a strong institutional capacity for the private sector to manage energy conservation-related investments and programs. Activities were accomplished in support of the project objectives including: establishment of a Demonstration Loan Fund, the accreditation of nine financial institutions, approval of 13 demonstration subprojects, and initiation of energy conservation training and promotion ~~activities~~.

The project will not achieve its objectives because the expected project results are not attainable in the time remaining to complete this project. Also, the status of some objectives could not be verified because baseline data needed to measure project results did not exist and was not developed. The following table compares the expected results at the end of the project, according to the project paper, and their status at the time of audit.

EXPECTED RESULTS	STATUS
Increased numbers of industrial, commercial, and building owners/managers adopt new technologies.	Undeterminable without baseline data, but the project initiated 13 demonstration subprojects.
Increased volume of private sector requests for analytical and technical assistance from local institutes and U.S. consultants.	Undeterminable without baseline data; however, the project financed work by U.S. consultants. No indication of increased requests of local institutions.

Increased private sector energy conservation promotion activities.	No evidence that the private sector has promoted energy conservation.
Increased numbers of loan applications processed for equipment purchases and requests for energy tax incentives.	Loan requests identified were only for the project's loan fund. No increase in requests for energy tax incentives.
Increased formation of local consulting groups to provide energy conservation services.	No indication that there was an increase in the formation of such groups.

There Is No Assurance that Project Activities Will Be Completed or Accomplishments Replicated

A.I.D. policy requires energy programs to be relevant to the country's development priorities in order to sustain them after external assistance ends. It also provides that positive project results should be sustained after A.I.D. assistance ends. Because most of the demonstration subprojects will not be completed and studied until after the project's completion date, the GOP may not continue the project's activities after A.I.D funding ends. While the GOP has agreed to use the demonstration subprojects for promoting energy conservation technologies, no plans exist for promoting, conducting, or reporting on the studies. The project did not reach the level of outputs expected because energy conservation was not a high priority in the GOP's development plans, A.I.D.'s development assistance for the Philippines or the private sector's investment plans. As a result, A.I.D.'s $4.5 million investment initiative likely will not be sustained.

Recommendation No. 1: We recommend that USAID/Philippines establish an agreement with the Government of the Philippines for specific actions needed to complete project activities and to sustain the

beneficial results of the project, including assigning responsibilities for monitoring demonstration projects, promoting their results, and reporting to A.I.D.

The A.I.D. policy paper on energy provides that energy programs be relevant to the host country's development priorities so that they may be sustained after external assistance ends. The programs should be tailored to country needs based on factors such as the availability of natural resources, private sector investments and other donor assistance. Section 101(a)(2) of the Foreign Assistance Act states that foreign assistance funding is provided to promote conditions which enable developing countries to achieve self-sustaining growth. A.I.D. Handbook 3 states that, prior to the completion of A.I.D. assistance, a number of continuing responsibilities must be considered, including the adequacy of funding for the continued operation of the project.

The project paper described in broad terms the level of outputs to be achieved by the end of the project. Calculating these expected outputs to reflect the delayed start and comparing to actual achievements, we find that the project has not achieved the intended results.

Category of Outputs	Level of Outputs		
	Planned	Revised 1/	Actual
Demonstrations (completed)	48	29	3
Seminars - one per demonstration or study	80	48	None
Training sessions	70	42	11
Professional exchanges	30 - 40	18 - 24	2
Technology studies	70	42	38
Policy studies	10	6	None

Attendance at workshops/seminars	1600	960	560
Banks adopting new financial mechanisms	Undefined		None
Bankers and donors starting new funding efforts	Undefined		None

1/ Planned levels were reduced by 40 percent to reflect the two-year delay in project activity.

The number of demonstration subprojects was not met. With less than a year before the project ends, only 13 subprojects have been approved and three more are expected to be approved by the end of the project. As of March 1990, $2,435,000 in A.I.D. funds had been obligated for the demonstration loan fund with $1,834,000 applicable to 15 subprojects. Funding for one subproject had yet to be determined. USAID/Philippines officials indicated that about $500,000 would be deobligated.

Despite the project being designed to promote energy conservation investments, some of the approved subprojects would have been developed without the TTEM project. Three of the four subprojects reviewed by us were conceived before the TTEM project began. The oxy-fuel-burner and air conditioning plant linkage subprojects were conceived in 1983. The design and initial purchase of equipment for the heat exchange modification subproject began before the company knew of the TTEM project. Also, the replicability of these subprojects was questioned in the 1987 project evaluation report. The report stated that the air-conditioning plant linkage which joins the air-conditioning systems of two buildings does not appear to be replicable. The report further stated that the oxy-fuel-burner, air-conditioning plant linkage, and heat-exchange modification subprojects were non-TTEM energy conservation technologies.

The project was to develop and demonstrate innovative financing mechanisms for energy conservation. In addition to conventional loans, the project was

to try loans with repayments tied to energy savings, grants or combination of these. However, all but one of the 13 subprojects used conventional loan: One subproject was financed through a combined conventional loan an grant. Participating banks were reluctant to use innovative financing methods A bank official said that loans with repayments tied to energy savings ar risky.

The project was designed to stimulate additional funding from privat financial institutions and international donors. However, energy conservatio is not a lending priority of financial institutions. Except for the demonstration loan funds, none of the participating banks made energy conservation loans Bank officials stated that the current priority in financial markets is fo company expansion.

The project failed to achieve project outputs because energy conservation not a high priority of USAID/Philippines, the GOP or the private secto USAID/Philippines' strategy for fiscal years 1986 through 1990 did no consider energy conservation to be a development priority for the Philippines Except in fiscal year 1990, when energy conservation was classified under private sector employment generation, the annual action plans, updating th USAID strategy, did not mention energy conservation or this project.

Despite being one of OEA's institutional mandates, the GOP does nc consider energy conservation a high priority. A GOP energy official lamente that energy conservation is emphasized only in times of crisis; it is not continuing activity.

The private sector does not give energy conservation a high priority eithe Some bank officials tried marketing the project by sending letters to 40 of th bank's preferred clients. The results were discouraging--only eight businesse showed interest in the project. Businessmen and bank officials rate energ conservation programs to be one of their lowest priorities. Bot USAID/Philippines and GOP officials said that businessmen are mor interested in initiating projects to preserve market share than participating i energy conservation projects. In fact, most demonstration subprojects wer to increase production capacity with conserving energy as an added benefit.

For instance, the oxy-fuel-burner and heat-exchange modification subprojects were designed primarily to increase production capacity.

The construction of most energy conservation demonstration subprojects will not be complete by December 30, 1990. At the time of the audit, three subprojects were complete. Ten other subprojects were to be completed by December 1990 with three new subproject expected to be approved by that date. However, delays in the construction of these demonstration subprojects may occur. Of the four subprojects reviewed, none were completed within the original time frames. For example, in December 1989, the technical assistance contractor's monthly report indicated that the air-conditioning plant linkage subproject, which was the first demonstration subproject, would be complete by February 1990. The January 1990 report moved back the estimated completion date to April 1990. A company official now estimates that the subproject will be complete in June 1990. Three of the 10 on-going subprojects were initially estimated to be complete in December 1990. Any delay in their construction will put the subprojects beyond the project completion date. Appendix V outlines the original and revised time frames of the 13 approved subprojects. For those completed the table shows that the time to complete the subprojects more than doubled the original estimate.

To demonstrate the energy conservation technologies used in the subprojects, project officials intended to have case studies prepared and to use these to promote the adoption of the technology. Not only are the subprojects not complete, but no plans exist for the individual case studies to be performed. It is unreasonable to believe that case studies can be planned and completed by December 1990. A TTEM project office official said that at least two years of subproject monitoring is needed before a meaningful case study can be developed for each subproject. If true, no case studies will be developed from any of the subprojects by the December 30, 1990, project completion date. Because most demonstration subprojects are not complete, energy conservation technologies will not be demonstrated during the life of the project. Without a commitment from the GOP to complete the case studies after the project ends, the potential benefits of the demonstration subprojects will not be realized.

Besides not having a plan for subproject case studies, the GOP has not identified resources for monitoring the existing subprojects. Further, we doubt that the GOP will continue the project activities after A.I.D. funding ends. The senior project staff, consisting of the project director, two senior project officers and the senior financial officer are paid from A.I.D. funds. The GOP contribution was limited to providing contractual support staff for the TTEM project office. Moreover, the salaries of the AID-financed project staff exceed the GOP salary levels; therefore, these persons could not be hired by the GOP at their present salary levels. OEA has no plans to absorb the AID-funded project staff because there has been no budgetary increase for OEA to pay the salaries of the TTEM project staff.

In January 1990, USAID/Philippines tasked the technical assistance contractor to conduct an institutionalization study of the project. The study was to assess the project's performance and recommend measures for continuing project activities after A.I.D. assistance ends. Essentially, the report shows that little institutionalization had taken place thus far. The study recommended the creation of a foundation to continue the TTEM activities. A GOP official hopes that a World Bank energy sector loan can be used to continue project activities. At present, there exists no mechanism to sustain the beneficial results of this project.

Management Comments and Our Evaluation

In a letter to USAID/Philippines, dated May 31, 1990, OEA reiterated its commitment to continue monitoring all subprojects, prepare case studies and conduct seminars on the results of the demonstrated technologies both before and after project completion. A time-phased plan for these activities was to be implemented beginning June 1, 1990, and OEA is working with the Department of Budget and Management for the continued employment of the TTEM junior staff through 1991. OEA is also working on action programs aimed at the continuation of TTEM activities after project completion, including government approval for continuation of project activities, the creation of a permanent revolving development loan fund and the transfer of fund management to the Development Bank of the Philippines. OEA expects

that all subprojects, related case studies and dissemination activities will be completed by December 31, 1991. At that time OEA will provide USAID/Philippines with a final report. This commitment by OEA for the balance of the project and beyond will be formalized in a Joint Project Implementation Letter.

This plan of action is responsive to Recommendation No. 1, which is resolved and can be closed when the Joint Project Implementation Letter is completed and approved.

APPENDIX L
LIST OF ACRONYMS AND ABBREVIATIONS

APPENDIX L: LIST OF ACCEPTED ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AICHE	American Institute of Chemical Engineers
ASME	American Society of Mechanical Engineers
BAP	Bankers Association of the Philippines
BEU	Bureau of Energy Utilization
BOE	Barrels of Oil Equivalent
BOI	Board of Investments
CB	Central Bank of the Philippines
cfm	Cubic Feet per Minute
DBM	Department of Budget Management
DBP	Development Bank of the Philippines
DENR	Department of Environment and Natural Resources
DLF	Demonstration Loan Fund
DOI	Department of Industry
ENMAP	Energy Management Association of the Philippines
ESMAP	Energy Sector Management Assistance Program
GOP	Government of the Philippines
hp	Horsepower
IRR	Internal Rate of Return
KBOE	Thousand Barrels of Oil Equivalent
kg	Kilogram
Kltrs	Thousand Liters
LOP	Life of Project
MP	Million Pesos
MRR	Manila Reference Rate
MT	Metric Tons
MW	Megawatts
MWH	Megawatt Hours
NEC	National Engineering Center
NEDA	National Economic Development Authority
NPC	National Power Corporation
OEA	Office of Energy Affairs
P	Peso
PACD	Project Assistance Completion Date
PCCI	Philippine Chamber of Commerce and Industry
PDCP	Private Development Corporation of the Philippines
PFI	Participating Financial Institution
PLDT	Philippine Long Distance Telephone Company
PNOC	Philippine National Oil Company
RA	Resident Advisor
RFP	Request for Proposal

RIG/A	Regional Inspector General/Audit
RMA	Resource Management Associates of Madison, Inc.
SC	Steering Committee
SSC	Subproject Selection Committee
T & D	Transmission and Distribution
TAC-SAL	Technical Assistance Component of the Second Structural Adjustment Loan Project
TTEM	Technology Transfer for Energy Management Project
UNESCO	United Nations Educational Scientific and Cultural Organization
UP	University of the Philippines
USAID	United States Agency for International Development

DLF SUBPROJECT ACRONYMS AND ABBREVIATIONS

ALSONS	C. Alcantra and Sons, Inc.
AMAC	Armco-Marsteel Alloy Corporation
ARTIMCO	Aras-Asan Timber Company, Inc.
BCI	Bacnotan Consolidated Industries, Inc.
BELL	Bell Carpets International Manufacturing, Inc.
BENGUET	Benguet Corporation
CADP	Central Azucarera Don Pedro Sugar Mill
CEPALCO	Cagayan Electric Power and Light Company, Inc.
CFIC	Central Fermentation Industrial Corporation
ILPI	Iligan Light and Power, Inc.
KSLI	Kalinisan Steam Laundry, Inc.
MVC	Mabuhay Vinyl Corporation
PLDT	Philippine Long Distance Telephone Company
RCC	Republic Cement Corporation
RWPI	Rubberworld Philippines, Inc.
SUPERPLY	Super Plywood Corporation
TIPCO	Trust International Paper Corporation
UGCC	Union Glass and Container Corporation