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AM-55376

AUDIT OF  
RURAL ENERGY DEVELOPMENT  
PROJECT NO. 492-0375

AUDIT REPORT NO. 2-492-88-14-N  
MARCH 29, 1988

UNITED STATES GOVERNMENT

# Memorandum

TO: Mr. Frederick Schieck  
Director, USAID/Philippines

DATE: March 29, 1988  
RIG/EA-88-171

FROM: Leo L. LaMotte *Leo L. LaMotte*  
RIG/A/M

SUBJECT: Audit Report No. 2-492-88-14-N  
Audit of Rural Energy Development, Project No. 492-0375

Attached is a copy of the final report on the subject audit. The certified public accounting firm of Joaquin Cunanan & Co., Manila, Philippines prepared the report dated January 11, 1988. A separate report of the exhibits mentioned in the report will not be issued, rather they will be maintained in RIG/A/Manila offices. The report containing the exhibits will be made available to USAID/Philippines because the exhibit report contains the specific details needed by the USAID to resolve the recommendations shown below.

The purpose of the review was to determine whether project funds were being properly accounted for in compliance with the terms of the grant and other applicable A.I.D. policies and procedures, and to identify and evaluate the internal accounting and administrative controls of the fund. The auditors reviewed accounts, reports and other relevant documents to determine the adequacy of the accounting systems and procedures. Transactions totaling \$1.2 million or approximately 52% of funds disbursed for project implementation were verified. Of this amount, \$103,771 in costs have been questioned or recommended for disallowance.

On the basis of audit procedures performed, the auditors suggested several improvements to the systems and internal controls to better protect USAID/Philippines funds. Of specific concern is the procurement of gasifiers where the bidding process or awarding of contracts was not in accordance with A.I.D. regulations. The auditors also concluded that the Department of Agriculture, which has absorbed the dissolved implementing agency, Farm Systems Development Corporation, is obligated to remit back to the ESF fund \$36,220 to cover unapproved installation costs and loan releases.

As a result, the following recommendations will be included in the Office of the Inspector General's audit recommendation follow-up system.

Recommendation No. 1

We recommend that USAID/Philippines resolve \$103,771 in questioned and suspended costs and issue a bill of collection as appropriate. USAID/Philippines should also ensure that the amount of \$34,988 for the unapproved installation costs and loan releases and \$1,232 representing loan releases recalled but still appearing in the liquidation reports be remitted back to the ESF fund.

On March 11, 1988, we were informed by the ESF Secretariat that the amount of \$34,988 has been refunded to the ESF fund. We will consider this recommendation closed after we receive the supporting documents showing that \$36,220 has been remitted to the ESF fund.

Recommendation No. 2

We recommend that USAID/Philippines make a determination as to who is responsible for making sure that the subprojects equipment is made operational, or for dismantling and salvaging sites when appropriate. USAID/Philippines should monitor these actions and consider A.I.D.'s policy on recurrent costs in resolving these recommendations.

Please advise this office within 30 days of the actions planned or taken to implement these recommendations.

## *Joaquin Cunanan & Co.*

11 January 1988

Mr. Leo L. La Motte, J.D., CPA  
Regional Inspector General for Audit  
Office of the Inspector General - Audit  
Agency for International Development  
Ramon Magsaysay Center  
1680 Roxas Boulevard, Manila

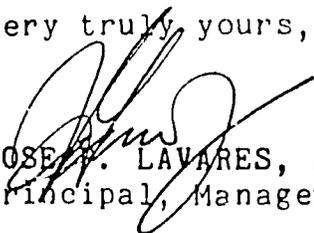
Dear Mr. La Motte:

Report on the Results of a Financial Audit of the USAID  
Funded Rural Energy Development Project and a Physical  
Survey of Project Funded Gasifier, Silviculture and  
Charcoal Production Sites

We are pleased to submit our final report covering the results of the financial audit and physical survey of the gasifier, silviculture and charcoal production projects under the Rural Energy Development Project. The financial audit was completed on September 30, 1987 while the physical survey of the gasifier, silviculture and charcoal production projects was conducted from August to October 1987. A preliminary report was earlier submitted and the comments received were incorporated into the final report.

Thank you for giving us the opportunity to carry out this assignment and allowing us to reconstitute our final report to address primarily the requirements of a financial and compliance audit and similarly, the interest of your project officers.

Very truly yours,

  
JOSE F. LAVARES, JR.  
Principal, Management Consulting Services

Report on the Results of a Financial Audit of  
the USAID Funded Rural Energy Development  
Project and a Physical Survey of Project Funded  
Gasifier, Silviculture and Charcoal Production Sites

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## EXECUTIVE SUMMARY

### I. Background

In 1982, through a USAID-Philippine government agreement, USAID provided an \$11 million grant fund for the Rural Energy Development Project to assist the Government of the Philippines develop economically and environmentally viable rural energy technologies. With the abolition of Farm Systems Development Corporation (FSDC), the implementing agency, and because of current economic viability issues, the project has been terminated or closed out.

An audit of project operations - expenditures and equipment purchased with project funds - is required in order to properly close out the project. Joaquin Cunanan and Co. was therefore commissioned by RIG-Audit, Manila Office to conduct a two-phase audit of the project, as follows:

- 1) financial and compliance audit covering the books of accounts of USAID, FSDC and as necessary, the sub-implementing agencies
- 2) physical survey of gasifiers, silviculture and charcoal production sites

### II. Major Findings and Recommendations

#### A. Findings

The financial audit covering the review of internal controls, compliance and substantive tests and other tests of disbursement funds revealed that:

- (1) FSDC is under obligation to remit back to the ESF Fund \$34,988 covering unapproved installation costs and loan releases;
- (2) FSDC Rural Energy Development Project Funds were co-mingled with other funds of various sources and were simply pooled in a general bank account;
- (3) Major transaction documents such as check vouchers (with amounts ranging from \$16,000 to \$38,000) were missing and could not be verified;
- (4) Transfer of project equipment (gasifiers) were not all properly documented through Memorandum Receipts (MR) properly signed and acknowledged

by recipient Integrated Services Association (ISA) or its authorized representative;

- (5) No serious efforts were exerted to collect on the commodity loans (gasifier) to ISA; and
- (6) Copies of major contracts that should reach USAID, such as the supply contract for gasifiers, did not reach USAID for proper approval.

The physical inventory of gasifiers revealed the following:

- (1) Most gasifier installations are in need of repair/replacement parts; out of 258 units inspected, 200 need repairs to be operational.
- (2) Repair/replacement costs of inventoried gasifiers range from \$50.00 to \$1,550.00 per unit, or a total of approximately \$175,000.00.
- (3) FSDC established diesel displacement ratio of 90% is hardly attainable; likewise average number of operating hours per year of the gasifiers was at a low 115 compared to an optimal 800 hours as established by FSDC.

The survey of tree farms and charcoal production sites, on the other hand, showed that:

- (1) only 16% of the covered areas were effectively planted;
- (2) most covered areas have poor accessibility and are highly affected by peace and order problems resulting in the current poor to fair management of the tree farms;
- (3) most farms ready for harvest are beset with financial problems and do not have the requisite permit to harvest or license to operate from the Bureau of Forest Development;
- (4) only two tree farms have charcoal kilns which presently are not in operation.

## B. Recommendations

To help implementors, coordinators and other agencies to effectively monitor and control project funds and equipment, the following are recommended:

1. Project funds provided by USAID should be segregated from other funds of the implementing agency to properly control and establish statuses of funds on a periodic basis.
2. Records and documents relating to the project should be properly kept, for the expedient review by AID authorized representatives during project execution, and at least three years after project closure.
3. Identified project recipients such as farmer associations (ISA & KAISA) must be properly informed of project covenants particularly agreements on securing commodity loans (e.g. gasifiers) with implementing agencies (e.g. FSDC) and the inherent obligations arising from said agreements.
4. Implementing agencies should be encouraged to strictly monitor project equipment performance by providing adequate documentation of observed technical defects, operating performance weaknesses and corrective measures taken to eliminate such technical defects/weaknesses. Also, project equipment records must be kept up-to-date and should provide adequate details on original cost, installation costs, maintenance, description of major repairs made and cost involved.
5. The Department of Agriculture, FSDC's absorbing government agency, should evaluate the merits and demerits of the gasifier, silviculture and charcoal production projects. These may serve as valuable inputs to other government programs designed at helping the country's marginal farmers and more importantly, to determine the future course of action to be taken on the project, if any.
6. The studies conducted by the Asian Institute of Management should be given due consideration if the gasifier project is to be rehabilitated and/or converted into a woodchip system.

## RESULTS OF THE AUDIT AND SURVEY

### I. Financial and Compliance Audit

#### A. Overall Background of the Project

In 1982, through a USAID-Philippine government agreement, USAID provided an \$11 million grant fund for the Rural Energy Development Project to assist the Government of the Philippines (GOP) develop economically and environmentally viable rural energy technologies. The fund was established to support the following subprojects:

1. Farm Systems Development Corporation (FSDC) gasifier project for irrigation for the benefit of some 26,000 farmers. This envisioned the conversion of some 495 diesel fueled irrigation pump systems to combined diesel/gas system by retrofitting gasifiers to the engines.
2. FSDC's tree plantation for charcoal production. This program envisioned establishing 76,000 hectares of tree farms for charcoal production to support the gasifier project and sustain the charcoal requirements of household, industrial and agricultural users.
3. National Electrification Administration's (NEA) 5 megawatt wood fired power plants. This program intended to establish forty (40) 5 Megawatt wood fired power plants by 1987.

Over the intervening years, the projects' grant agreement had been amended several times, substantially reducing the scope of the project due to the incapacity of counterpart organizations, lack of counterpart funding and changes in the energy market causing changes in the economies of technologies involved. The wood fired power plant sub-project was cancelled and its funds deobligated with no AID funds ever disbursed. The gasifier and charcoal production subprojects have been partially implemented by FSDC which has subsequently been ordered dissolved by its new parent organization, the Department of Agriculture.

As there is no evident appropriate organization to transfer the project to and since there are current economic viability issues concerning the gasifiers, it has been agreed by AID and the Economic Support Fund

(ESF) Secretariat to close out the project and return unused funds to the ESF pool. An audit of the project operations and expenditures and equipment purchased with project funds is required in order to properly close out the project.

The audit consisted of a two-phase appraisal, namely:

1. The conduct of a financial and compliance audit covering the audit of the books of accounts of USAID, FSDC and as necessary, the sub-implementing organizations of FSDC (e.g., KAISA & ISA) to determine if proper procedures have been followed in the procurement of goods and services and accounting for the use of funds.
2. A physical survey of project funded gasifiers, silviculture and charcoal production sites to identify the location/condition of equipment and sites, assess project impact in meeting project objectives and make technical recommendations on operation, modification, mothballing, replacement or other disposition of the gasifiers, or on operation or termination of the fuelwood sites.

B. Objectives and Scope of the Financial and Compliance Audit

A financial audit of the books of USAID, Farm Systems Development Corporation (FSDC) and its sub-implementing organizations was conducted to determine if accounting of project funds, methods of disbursements, use of funds and procedures for liquidation meet project documents specifications and AID regulations.

All transactions at the FSDC Head Office were reviewed and audited. In addition, one of the six area offices of FSDC, Area IV and one sub-implementing organization was selected to track down disposition of funds. Procedures employed were: a) review of books of accounts maintained at FSDC central office, Area IV and the sub-implementing agencies, a Kalipunan ng mga ISA (KAISA) and one Integrated Services Association (ISA) covering 1982 to early 1986 transactions, b) inspection of various documents, agreements, contracts and other supports to validate the appropriate use of funds, c) analytical review of certain financial information to identify and provide basis for inquiry, d) discussions and interviews with accounting personnel, area manager, ISA president, etc., e) review and evaluation of the

internal controls including compliance and substantive tests, and f) other procedures considered necessary to establish whether disbursements were properly allocated and adequately supported.

At the time (Oct. 1987) of the audit, major transactions of FSDC were limited to settling obligations with suppliers and other third party claims and turning over of the project to the Department of Agriculture. There were no new project disbursements. As of December 31, 1987, FSDC was officially closed and endorsed to the Department of Agriculture.

Of the \$11 million grant funds \$1.2 million was verified. This involved disbursements for the period 1982 to 1985. Test of transactions was performed involving 25% of the verified amount or a transaction volume of \$300,000. Exceptions noted are presented in detail in the Findings and Recommendations section of this part of the report. Likewise, included as Section C is the Auditor's opinion on the examination performed and on the project's internal control system.

C. Auditor's Opinion

USAID-FUNDED RURAL ENERGY DEVELOPMENT PROJECT

We have performed a financial and compliance audit of the books and records of USAID, Farm Systems Development Corporation (FSDC) and its sub-implementing organizations to the extent necessary to meet the objectives and scope described in section I-B and to satisfy ourselves on the receipts and disbursements of project funds for the period 1983 to 1986 as summarized under the accompanying Exhibit III. Our examination was made in accordance with generally accepted auditing standards, including the U.S. Comptroller General's audit standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstance.

In our opinion, except for the findings discussed in section I-D, (a) the statement of liquidation shown in Exhibit III presents fairly the receipts and disbursements of funds of the USAID Funded Rural Energy Development Project for the period 1983 to 1986, in conformity with generally accepted accounting principles and (b) the accounting of funds, methods of disbursements and use of funds and liquidation procedures of FSDC and its sub-implementing organizations substantially complied with the project's documentation specifications and AID regulations.

*Josquin Amador, Jr.*

October 28, 1987  
Makati, Metro Manila

USAID FUNDED RURAL ENERGY DEVELOPMENT PROJECT

REPORT ON INTERNAL CONTROL SYSTEM

AUDITOR'S OPINION

We have performed a financial audit of the USAID-Funded Rural Energy Development Project implemented by the Farm Systems Development Corporation for the period from 1982 to early 1986 and have issued our report thereon dated October 29, 1987. As part of our examination, we made a study and evaluation of the Farm Systems Development Corporation's system of internal accounting control to the extent we considered necessary to evaluate the system as required by generally accepted auditing standards. The purpose of the study and evaluation was to determine the nature, timing and extent of the auditing procedures necessary for expressing an opinion on whether the project's disbursements were properly allocated and adequately supported. Such a study and evaluation would not necessarily disclose all weaknesses in the system which a more extensive review might develop. Accordingly, we do not express an opinion on the system of internal accounting control of Farm Systems Development Corporation taken as a whole. However, our study and evaluation disclosed the conditions described in the accompanying findings 2 to 8, which in our opinion result in a relatively low risk that errors and irregularities in amounts that would be material in relation to the Rural Energy Development Project, implemented by the Farm Systems Development Corporation, may occur and not be detected within a timely period. It is our opinion, therefore, that the system of internal accounting control of the Farm Systems Development Corporation applicable to the Rural Energy Development Project is adequate with respect to the safeguarding of the funds from irregularities in amounts that may be material to the project.

*Josquin Cuvaran*

October 29, 1987  
Makati, Metro Manila

#### D. Findings and Recommendations

The financial audit was completed on September 30, 1987 and a preliminary report thereon was submitted for comments on October 6, 1987. Detailed tests and related findings are itemized in Exhibit I. The summary of procedures implemented in the tests covering the procurement of goods and services and use of funds is shown in Exhibit II. Our detailed findings and recommendations are as follows:

##### Finding No. 1

The amount refunded by FSDC per statement of liquidation to the Economic Support Fund (ESF) totaled \$388,892.00. However, the audit disclosed that this should have been \$423,880.00, a difference of \$34,988.00 representing expenses incurred prior to October 1981, installation costs and loan releases recalled and not approved by USAID in 1975. A more detailed statement of liquidation is presented in Exhibit III.

The analysis is as follows:

Receipts		\$1,200,035
Less: Disbursements		
Gasifier Project	\$517,168	
Charcoal Production Project	293,975	811,143
	-----	-----
		\$ 388,892
Add: Disallowable Disbursements	\$ 33,756	
Loan Releases Recalled	1,232	34,988
	-----	-----
		\$ 423,880
Less: Amount Returned to FSDC		388,892
		-----
Amount Still Due to ESF		\$ 34,988
		=====

Note: All amounts in this report were converted to US dollars at the average prevailing foreign exchange rates during each transaction year (1981 - P7.90; 1982 - P8.30; 1983 - P14.00; 1984 - P18.00; 1985 - P18.90; 1986 - P20.50).

Source: Central Bank of the Philippines

Recommendation No. 1

Our analysis based on the amounts received and disbursed by FSDC indicates that a refund of \$34,988.00 is still due to the ESF.

Finding No. 2

Funds received from Economic Support Fund - Ministry of Human Settlements (ESF-MHS) intended for the Rural Energy Development project were co-mingled with other funds being handled by FSDC. The Implementing Agency (IA) maintained a general bank account where all funds received from the different donors were deposited.

Under Sec. B.5(b) of Annex II, the Grantee will maintain or cause to be maintained, in accordance with generally accepted accounting principles and practices consistently applied, books and records relating to the Project and to this Agreement, adequate to show, without the limitation, the receipt and use of goods and services acquired under the Grant or supported by transfers of the Grant. Furthermore, under Sec. D.2(f) of Annex II, any interest or other earnings on Grant funds disbursed by USAID to the Grantee under this Agreement prior to the authorized use of such funds for the Grantee should be properly segregated and accounted for. Since the Project's fund was mingled with other funds, interest income thereon was not determined.

Recommendation No. 2

A specific bank account should be maintained by the Republic of the Philippines Implementing Agency to properly control the USAID funds.

Finding No. 3

Various check vouchers were missing or unlocated. Our review disclosed several check vouchers which were missing or unlocated during our examination, as follows:

Drawer	Reference	Particulars	Amount
-----	-----	-----	-----
FSDC-Central Office	CK #227905	Purchase of Gasifier equipment	\$38,568
	029354	Tree farm loan releases	3,458
KAISA-CAPIZ	CV # 12670	First direct release-Tree Farm Project	6,098
	13128	Second direct release-Tree Farm Project	6,017
	13436	Third direct release-Tree Farm Project	5,987
KAISA-ILOILO	17981	Ninth direct release-Tree Farm Project	7,423
		Total	\$ 67,551
			=====

Under Article IV (4.1) of Annex II (Project Standard Provisions), the Implementing Agency shall maintain or cause to be maintained, for the duration of the project and for three (3) years thereafter and in accordance with generally accepted accounting principles and practices, books of accounts and such necessary records and documents relating to the Project under this Agreement. Since the Implementing Agency has been ordered dissolved by its new parent organization and the project ultimately terminated, a substantial number of employees were retrenched leaving a few employees to wind-up its operations. As a result, documents and records were all dumped in a warehouse making it difficult to locate vouchers needed.

#### Recommendation No. 3

The Implementing Agency should maintain necessary records and documents relating to Rural Energy Development project for its duration and for three (3) years thereafter.

#### Finding No. 4

Memorandum Receipts (MR) supporting the releases of gasifiers and add-on-filters to various ISAs were not acknowledged to have been received by the recipients to evidence actual delivery. For USAID purposes, all activities financed with the project's funds should be properly documented. The IA did not place so much emphasis on having the MR's acknowledged to have been received as long as there is an assurance that the equipment reached the corresponding ISA.

Recommendation No. 4

In future projects, Memorandum Receipts should be properly filled up by the recipients to evidence receipt of equipment.

Finding No. 5

Awarding of the contract to supply gasifiers to the Gasifier and Equipment Manufacturing Corporation (GEMCOR) by FSDC was not supported by letters of approval either from the ESF or USAID.

In procuring the gasifiers, two American firms and one local firm (GEMCOR) submitted their price quotations. According to FSDC, in the bidding process, it was only GEMCOR who submitted an equipment design. The contract was awarded to GEMCOR (a government owned corporation) who won in the prequalification bid. However, no documentation was available to support that this decision was approved by ESF and USAID. Hence, we do not have information on the amount of bids. However, before FSDC entered into an agreement with GEMCOR, FSDC first obtained the approval of the former President of the Philippines.

Under Section C.3(a) and (b) of Annex II of the Agreement, the grantee will furnish to AID, upon preparation, the documents related to the prequalification of contractors, and to the solicitation of bids or proposals for goods and services, and for such other services, equipment, materials as may be specified in Project Implementation Letters. These documents will be approved by USAID in writing prior to execution of the contract. However, the gasifier supply contract was awarded to GEMCOR since it was the only firm who presented an equipment design for the gasifiers.

Since there were no available documents to support the approval of USAID regarding the awarding of gasifier supply, and no price quotations from the different firms were available, it was impossible to determine whether the decision was authorized and that the contract was awarded to the firm having the lowest bid.

Recommendation No. 5

The Implementing Agency should furnish USAID all documents related to prequalification of contractors and the solicitation of bids for equipment, for the latter's approval before execution of the contract.

#### Finding No. 6

No collections have been received from the loans granted under the Rural Energy Development project.

We noted that loan collections received from the beneficiary associations were first applied to loans previously availed of prior to the Rural Energy Development project. Under Article VII, Annex I of the Memorandum of Agreement for Gasifier and Charcoal Project, each of the total yearly releases under these projects shall have six and twelve years repayment, respectively, inclusive of a four-year grace period. Under the IA's procedures, all loan collections received were applied first on the previous loans availed of by the beneficiary associations prior to the Rural Energy Development project. Because of this condition, the ISA's have in effect not remitted any repayments on the financial assistance extended to them by the ESF Secretariat under this project.

#### Recommendation No. 6

The Department of Agriculture (parent organization of FSDC responsible for dissolving the latter) should look at the possibility of assuming FSDC's right to collect from the ISA's.

#### Finding No. 7

Recipients of the gasifier equipment (of the ISA sampled) were not aware that these were actually loans granted to them.

Our visit to one of the ISA's in Iloilo disclosed that members were not aware that the gasifier equipment installed in its farm, including installation costs and other expenses, are actually loans. Under Article VII, Annex I of the Memorandum Agreement for Gasifier and Charcoal Projects, the IA shall provide financial support or assistance to ISA's in the form of loans subject to the IA's financing procedures and requirements and to such other terms and conditions as the IA may deem proper to impose.

According to the officers of Banguit, Pungtod ISA, they thought that the gasifier installed in their area was a pilot project. As a result of the above situation, the ISA's were not aware that they had in fact incurred a loan and the payments which the ISA's are paying pertained only to the loans they acquired prior to the Rural Energy Development project.

Recommendation No. 7

ISA's should be made aware of their accountability to pay back the value of the gasifier equipment which they received. On the other hand, the IA should make it explicitly clear to the recipients that the assistance and equipment were actually loans subject to repayment and other terms and conditions.

Finding No. 8

Loan releases amounting to \$1,232.00 for the establishment of woodlot areas which were later recalled but which still appeared in the liquidation reports submitted by FSDC to the ESF Secretariat were not considered as valid disbursements.

The liquidation reports submitted by FSDC to ESF Secretariat included the following loan releases for the establishment of woodlot areas, which were later recalled. These were treated as disbursements.

<u>Name of ISA</u>	<u>Check No.</u>	<u>Amount</u>	<u>Remarks</u>
Jagnaya, Sto. Rosario	32094	\$1,121	\$960 was returned on October 22, 1985 per OR #3963096. The amount of \$32 was part of the \$33,756 disallowed by ESF.
Janguslob- Guinotos	32095	304	Returned on April 30, 1986 per OR #3969600

For USAID's purposes, all disbursements from the fund should be actually used in the implementation of the project. The Implementing Agency was not aware that it later recalled such releases. The amount still due for refund by the Implementing Agency to ESF was understated.

Recommendation No. 8

The Implementing Agency should include in the liquidation reports all disbursements actually used in the implementation of the Rural Energy Development project as well as disbursements or releases recalled.

## II. Physical Inventory of Gasifiers

### A. Background, Objectives and Scope

The gasifier project was an attempt to improve the traditional irrigation systems employed by marginal low land and mountain farmers. Over a period of seven years (1979-1985), 284 gasifiers units were effectively issued to various ISA's all over the country.

The gasifier inventory involved the following: (a) visiting around 275 installations plus an estimated 10 sites where uninstalled gasifiers are stored; b) identifying the location, description and condition of the equipment and the alterations or repairs that would have to be made; c) determining efficiency of operations including the amounts of petroleum substitution and, d) providing technical recommendations on the operation, repair, replacement and other disposition of the gasifiers inventoried.

A site visit to the Gasifier and Equipment Manufacturing Corporation (GEMCOR) was done last August 28, 1987 to provide the technical assistants an orientation on, and an actual perspective of, the different gasifier models (IS30, IS60, IS150).

Actual survey and inventory was conducted by 21 survey teams from September to October 8, 1987. A structured three-part questionnaire was developed and used in the actual physical survey as shown in Exhibit IV.

### B. Inventory Findings and Conclusion

#### a. Findings

Covered by the survey were 284 units installed for the period 1979 to 1985 (including those used in the pilot areas) - 2 units in 1979, 6 units in 1980, 6 units in 1981, 115 units in 1982, 123 units in 1983, 15 units in 1984, 9 units in 1985 and 6 units whose installation dates could not be established.

- 1) There were four (4) different models of the 284 gasifier units issued by FSDC to the ISA's: Model IS30, Model IS60, Model IS150 and Model IS250. Table 1 below shows the various models and the number of gasifiers inspected, established missing at the sites and those which could not be visited.

Table 1: Gasifier Models Issued to ISA's

	IS30	IS60	IS150	IS250	Uniden- tified Model	Total
	----	----	-----	-----	-----	-----
Units inspected at the sites	91	163	3	1		258
Units missing at the sites	1	8				9
Units not visited (inaccessible/site was highly affected by peace and order problem)	4	11			2	17
	----	---	---	----	---	---
	96	182	3	1	2	284
	===	===	===	====	===	===

2) Guided by FSDC records, 272 ISA's covered by the six area offices of FSDC and serving the country's twelve regions, 284 gasifiers were visited and key ISA officers were interviewed. Existing on sites and inspected were 258 out of 284 units or 91%. They are broken down by regions in the table below:

Table 2 - Inspected Gasifiers Units by Regions

Regions	Units Inspected	%
-----	-----	-----
I	23	9
II	44	17
III	9	4
IV	6	2
V	23	9
VI	64	25
VII	2	1
VIII	49	19
IX	14	5
X	2	1
XI	14	5
XII	8	3
	----	-----
	258	100%
	===	====

- 3) In assessing the operating condition of the major components of inspected gasifiers, parameters such as working or operational, corroded or deformed, defective or damaged and missing were used. The operating status of each component (e.g., reactor, scrubber, demister, final filter, mixing valves, pipings) was summarized for each unit. Below is a summary of the overall operating statuses of 258 gasifier units:

Operating Status -----	No. of Units -----
In Use: in good condition	1 unit
with some corrosion	4 units
	-----
	5 units
	-----
Not used but operational	29 units
Need repairs to operate	200 units
Not installed at the site	24 units
	-----
Total	258 units
	=====

- 4) The five (5) working units are utilized by ISA's in Topaz Proper, Camarines Sur, Talimagao, Aklan, Malugas Roadside, Cagasan and Villahermosa, all in Zamboanga del Norte.
- 5) The 29 units not used but operational are located in the following eight (8) regions:

Regions -----	No. of Units -----
I	6
III	1
IV	2
V	2
VI	9
VIII	1
IX	2
XII	2
---	---
Total 8	29
===	===

- 6) Gasifier units in need of repair shall, at current prices, require replacement/repair costs of \$174,387. Location by region, number of units, total and average replacement/repair costs are summarized in the table below:

Table 3 - Total/Average Cost to Replace/Repair Units by Region

Region	No. of Units	Cost to Replace/Repair	
		Total	Average
I	15	2282,397	P18,826
II	43	903,648	12,015
III	8	141,325	17,665
IV	4	123,001	30,750
V	16	188,049	11,753
VI	42	865,093	20,597
VII	2	7,220	3,610
VIII	43	576,043	13,395
IX	10	180,262	18,026
X	2	18,245	9,122
XI	9	134,492	14,943
XII	6	66,959	11,160
Total	200	P3,487,734	P17,434
	===	=====	=====
	or	\$174,387	\$ 871
		=====	=====

On the average, units installed in Region VII are the least costly to replace/repair (\$180 per unit) while units in Region IV are the most expensive to repair/replace (\$1,538 per unit). Average repair cost of the 200 units is \$871 per unit.

A detailed listing of replacement/repair costs of each of the 200 units is shown on Exhibit V.

- 7) The 24 units not installed at the sites are distributed among the following six (6) regions:

Regions -----	No. of Units -----
I	2
II	1
IV	12
VIII	5
IX	2
XI	2
Total	--- 24 ===

#### 8) Unassembled Gasifier Components

Covered by the physical count are component parts and common accessories of the different gasifier models stored in a warehouse at Angono, Rizal. These were inspected on September 28, 1987. It is informed that no listing of inventory items to be found in the warehouse was furnished the audit team. Table 4 shows the number and condition of various components and accessories inspected.

Table 4 - Unassembled Gasifier Components/Accessories  
(Common Parts) (in good condition)

	M O D E L			Total
	IS30 ----	IS60 -----	IS150 -----	
Major Component -----				
Reactor	23 (with serial no.)	64 (with serial no.) 5* (w/o serial no.)	12 (with serial no.)	99  5*
Demister	23	73	12	108
Final Filter	23	76	12	111
Scrubber	23	73 3*	12	108 3*

\*Defective

	IS30	M O D E L IS60	IS150	Others	Total
	----	-----	-----	-----	-----
Accessories/ Common Parts					
a) PVC Elbow				146	
b) PVC Pipe				152	
c) Flexible Rubber Hose				73	
d) Reactor to Scrubber Pipings				80	

\*Defective

9) With regard to the 22 ISA's which did not use their gasifiers although these are operational, the following are our findings:

i. Three of the eight (8) respondents who were satisfied with their gasifiers gave the following reasons for not using their gasifier systems:

No operating funds	-	1
Charcoal not available	-	1
Changed operator	-	1

ii. About 64% (9 out of the 14) respondents indicated they were not satisfied with their gasifiers because there was no fuel savings derived from operation. The others (5) gave the following reasons (this includes those neither satisfied or dissatisfied):

Inadequate water supply	-	1
Charcoal not available	-	1
No engine battery	-	1
No specific answer	-	2

10) For the 57 ISA's (Table 3) whose gasifiers totaling 200 units are not operational because the units need repairs:

i. About 33% (19 of 57) of the respondents indicated satisfaction with their gasifier systems.

ii. For the 38 respondents who were not satisfied with their gasifier systems, the following reasons were given:

Gasifier failure	-	10
Gasifiers give engine problems	-	5
No savings in operation	-	6
		---
Subtotal		21
Engine needs repair	-	2
Irrigation canal problem	-	2
Inadequate water supply	-	2
Charcoal not available	-	1
Inadequate funds	-	1
No specific answer	-	9
		---
Subtotal		17
		---
Total		38
		===

#### 11) Potential Fuel Savings from Operations

The potential annual fuel savings from gasifier operations are dependent on three factors: a) diesel fuel displacement ratio, b) operating hours per year, and c) price differential between diesel fuel and charcoal.

##### i. Diesel Fuel Displacement Ratio

The average diesel fuel displacement ratio as indicated by 67 respondents (includes respondents who previously used the gasifiers to the extent that members remembered respective fuel consumption) from ISA's whose gasifiers are in use, or operational but not in use, are as follows: (Exhibit VI)

Feedstock Used in Gasifiers	Average Fuel Displacement
-----	-----
Wood Charcoal	50.0%
Coconut Charcoal	57.7%

(According to FSDC Fact Sheet on Gasifiers, the expected maximum diesel fuel displacement ratio is about 90%)

ii. Operating Hours Per Year

Operational use of gasifier was established at 1200 hours per annum. However, FSDC established standards indicate that 800 hours of use yearly is optimal.

Practically all of the ISAs do not have reliable records of their gasifier operation since the equipment do not usually have monitoring instruments and devices installed.

The information on annual operating hours furnished by 39 respondents (includes respondents who previously used gasifiers) belonging to ISA's whose gasifiers are in use or operational but not in use indicated an average of only 115 hours/year (for 37 ISAs).

# Respondents	Annual Operations
-----	-----
23	1 - 100 hrs.
7	101 - 200 hrs.
4	201 - 300 hrs.
3	301 - 400 hrs.
-----	-----
Total 37	Average 115 hours
=====	=====

One ISA claimed operating 1,550 hours and another, 2,550 hours in a year.

The International Development Research Center (IDRC) of Canada funded Asian Institute of Management (AIM) study conducted in November 1985 on 53 ISA's in Panay Island (Region VI) showed an annual average of 600 hours for each ISA. This is only 75% (600 hrs./800 hrs.) of the optimal operating hours set for gasifiers to operate efficiently. Even at this level, ISA farmers would find difficulty in repaying their gasifier loans.

iii. Fuel Price Differential (Diesel vs. Charcoal)

Prices of fuel (100% diesel and diesel/charcoal) used to operate the gasifier vary significantly. Use of diesel/charcoal appears to be more cost effective than diesel as shown by the table below:

Table 5 - Comparative Cost of Diesel and Diesel/Charcoal Fuel to Operate Gasifier

Year	50 Horsepower Engine Running for one hour on 100% Diesel <sup>1/</sup>	50 Horsepower Engine Running for one hour on Diesel/Charcoal (50:50) <sup>2/</sup>		
		Diesel	Charcoal	Total
1982	\$2.08	\$1.04	\$1.00	\$2.04
1983	2.21	1.11	1.14	2.25
1984	2.60	1.30	1.72	3.02
1985	4.55	2.28	2.14	4.42
1986/ 1987	3.50	1.75	0.71	2.46

<sup>1/</sup> Engine rating (50HP or 37.335 kw) x fuel consumption per hour (0.348 liters/kw-hr) x diesel cost.

<sup>2/</sup> (0.5) x Engine rating (50 HP or 37.335 kw) x fuel consumption per kilowatt per hour (0.348 liters/kw-hr) x charcoal fuel conversion (2.2 kg/liter of diesel) x charcoal cost per kilogram.

The above costs were arrived at based on the price of diesel per liter and per kilogram of charcoal for the period from 1982 to 1987. Per liter prices of diesel were as follows: 1982 - \$0.16; 1983 - \$0.17; 1984-\$0.20; 1985 - \$0.35; 1986 and 1987 - \$0.27. The costs differential are influenced by the following factors: a) price of diesel; b) price of charcoal and c) diesel displacement ratio.

Even with a marked decrease in the price of diesel in 1986-1987 a 50/50 diesel/charcoal mixture is still cost-efficient.

#### b. Conclusion

It is apparent that the gasifier project was aggressively pursued by the implementing agency. After the first three years where 16 units were installed including those used in pilot projects, 115 were installed in 1982 while 123 units were made operational in 1983. These constituted 83% (238 out of 284 units) of

total installed units from 1979 to 1985. Results of pilot testing in terms of technical and operating efficiency have been proven acceptable but within the period 1982 to 1985, various problems arose, the most serious of which was the inability of the implementing agency to provide additional logistics and other institutional support needed by the project leading to unmonitored and undocumented performances of the gasifier units. The marginal farmers believe they benefited from this project. If the government, therefore, desires to rehabilitate the project, estimate of replacement/repair for 200 units at current prices is placed at approximately \$175,000. However, there appears to be no guarantee that once rehabilitated, the gasifiers' technical and operating efficiency will increase. Level of satisfaction of the ISA users vary, expectations on fuel displacement capacities have not materialized, and efficient operating hours still have to be attained. Technical questions as to the proper design of gasifiers and their matching with the engines still have to be reviewed.

#### C. Suggested Management Actions

The Department of Agriculture, the government agency which initially absorbed and finally decided to dissolve FSDC, should look into the merits/demerits of the gasifier project. Assistance to the marginal farmers is a continuing commitment of government to increase productivity/enhance farm income. Basic data and records are available from FSDC and studies of ALM and other institutions would facilitate the conduct of a cost-benefit analysis, specifically on the following:

1. rehabilitation of the entire gasifier project through:
  - a) replacement/repair of 200 units that can be made operational
  - b) conversion of the units to run on woodchips
2. creation and staffing of an organizational unit that can capably handle resources to provide continuing technical, operating and other necessary logistical support to users of gasifiers.

### III. Survey of Tree Farms and Charcoal Production Sites

#### A. Background, Objectives and Scope

The tree farm and charcoal production project was also directed at enhancing the productivity/income earning capacity of farmers and to support the gasifier program. Project implementation was also the responsibility of FSDC in coordination with the Bureau of Forestry Development. The physical survey and inventory involved the following tasks: a) visiting an estimated 12 tree farms and its charcoal production facilities; b) assessing the efficiency of planting and maintenance, quality of land and changes in silviculture practices to improve production and the condition and efficiency of any charcoal kiln, and estimating the number of acres planted; c) determining actual yield per acre for the different categories of planting for the woodlots and fuelwood plantations; and, d) to the extent possible, providing on the spot technical recommendations on improved silviculture methods or tree species appropriate to the site.

Two (2) foresters were fielded to the various tree farm sites. Actual survey was conducted from September 15 to October 28, 1987.

#### B. Survey Findings and Conclusions

##### a. Findings

Our foresters were able to visit 11 sites out of the 13 tree farms scheduled to be visited (one site - Marcos/Sarrat tree farm - had two (2) contiguous tree farms). For the two (2) projects that were not visited, namely San Joaquin, Iloilo and Puya, Datu Paglas, Maguindanao, the questionnaires (Exhibit VII) were accomplished thru interviews in the area offices of FSDC.

##### 1) Location, Coverage, Area Planted and Effective Area

As shown in Table 6 below, the total area coverage of the 13 tree farms is 17,847.18 acres while total area planted mainly with ipil-ipil (Leucaena leucocephala) is 4,858.10 acres. The effective area is 2,832.69 acres. In 1984, silviculture operations for most of the sites ceased due to problems on peace and order, financial and institutional support.

Table 6 - Summary of Areas Planted (acres)

Tree Project/ Location	Coverage Area	Planted Area (a)	Effective Area (b)	Effectiveness of Planted Area (b/a)%
1. Tarlac Tree Farm/Lubigan and Banaoang West Moncada, Tarlac	148.15	1.23	-	-
2. Marcos Tree Farm/Brgy. Marcos, Ilocos Norte	5,402.47	101.41	106.17	100%
3. Sarrat Tree Farm/Brgy. Pandao, Sarrat Ilocos, Norte	316.05	251.85	251.85	100
4. Iguig Tree Farm/Brgy. Campo, Iguig, Cagayan	864.20	501.23	81.48	16.7
5. Pres. Roxas Tree Farm/ Brgy. Bayugan Karangal and Lapunaya, Pres. Roxas, Capiz	202.86	38.37	23.56	61
6. San Joaquin Tree Farm/*	1,234.57	1,160.49	273.33	23
7. Barbaza Tree Farm/ Brgy. Madlad, Cadlao, Cala- padaan, Banang- bang and Narirong, Bar- baza, Antique	1,234.57	1,234.57	-	-
8. Atotay Tree Farm/Bucas Grande Island, Surigao del Norte	5,901.23	1,111.11	928.40	84

\* not visited

Tree Project/ Location	Coverage Area	Planted Area (a)	Effective Area (b)	Effectiveness of Planted Area (b/a)%
9. Puya Tree Farm*	24..69	24.69	19.75	79
10. Tagbalogo Tree Farm/ Tagbalogo, Naawan, Mi- samis, Oriental	1,234.57	497.53	434.57	87
11. Tagibay Tree Farm/Tagibay, Bayugan, Agusan del Norte	246.91	184.65	148.15	80
12. Torong-Torong Tree Farm/ Torong-Torong Tubod, Lanao del Norte	740.74	495.06	318.52	64
13. Lower Towak Tree Farm/ Matanao, Davao del Sur	306.17	246.91	246.91	100
	----- 17,847.18 =====	----- 4,858.10 =====	----- 2,832.69 =====	----- 58% =====

\* Not visited

## 2) Technical and Physical Condition of the Tree Farms

Exhibit VIII shows the technical and physical condition of the tree plantations visited. As reflected in said exhibit, the diameter of the trees ranges from a low of 6 cm. to a high of 45 cm., with most trees ranging from 8 cm. to 20 cm. in diameter. The regular spacing employed is 1m x 1m for most projects. Most tree farms have adopted crop protection measures. Management is normally fair to good for majority of the plantations. Except for three (3) tree farms with fragmented site

layout, the rest are planted in contiguous sites. Accessibility to the Atotay, Puya, Tagbalogo, Tagibay, and Torong-Torong Tree Farm is generally fair. The rest are only accessible by foot trails.

Ipil-ipil trees in most tree farm projects are ready for harvest. However, harvesting cannot be done in Marcos and Iguig Tree Farms due to lack of financial support while eight (8) plantations do not as of the audit date, have permit to harvest or license to operate from BFD. The seven (7) projects which do not have Industrial Tree Plantation (ITP) license from the BFD are Pres. Roxas, Atotay, Puya, Tagbalogo, Tagibay, Torong-Torong and Lower Towak Tree Farms.

Recommendations on the improvement of management and operations of the tree farms were made on the basis of an ocular inspection of the sites. These include the (1) adoption of stand improvement measures such as the establishment of firebreaks, undertaking of harvesting and thinning operations; (2) securing permit to harvest or license to operate from BFD; (3) treatment or cutting of disease infested trees; (4) relocation of some of the trees planted to areas near the road for ease in management; and, (5) introduction of other tree species toxic to pest infestation to prevent disease. The details of these recommendations are shown in Exhibit IX.

### 3) Charcoal Kiln Operations

Of the tree farms surveyed, only Barbaza and Pres. Roxas, have charcoal kilns but these, at present, are not in operation.

### 4) Tree Farm Management

Other specific findings on the management of the tree farms visited are shown on Exhibit IX.

## b. Conclusion

The unattended status of the tree farms is strongly manifested through various shortcomings such as the inability to secure a permit to operate/harvest, low planted acreage (only 16% of entire area planted), etc. Although complementing the gasifier project, it appears

that the implementing agency handled other projects which simultaneously demand consistent technical, financial and logistical support. A review of project merits and demerits again becomes necessary.

C. Suggested Management Actions

1. The positive impact of the tree farm/charcoal production project will also have to be viewed in a posture similar to that of the gasifier project. A cost-benefit analysis on the entire project should be undertaken. If help to the small farmers is again to be considered a major government thrust, the available documentation on project accomplishments and weaknesses could provide adequate inputs to project revival or rehabilitation.
2. Implementable short term and long term corrective measures ranging from thinning operations to major financial support for each tree farm are detailed on Exhibit IX. The Department of Agriculture is encouraged to consider these and establish implementation priority as resources would allow.

LOCATION: CALAOTIT ISA  
BACNOTAN, LA UNION



The reactor is located outside the pump house because of the heat generated by the burning charcoal. The top cover of the reactor can be opened to feed in charcoal. Note the portholes are closed. These holes regulate the inflow of air which assists in the burning of charcoal. This particular part is currently not working because of a defective refractory brick lining, top cover gasket and ash port gasket.

LOCATION: CALAOTIT ISA  
BACNOTAN, LA UNION



Diesel Engine with the gasifier retrofitted to the intake manifold. Note that it is also attached to a diesel fuel source. In working condition.

LOCATION: CALAOTIT ISA  
BACNOTAN, LA UNION



View of the final filter and demister inside the engine house. The demister serves to remove the moisture content of the gas before it enters the final filter and diesel engine. In working condition.

LOCATION: CALAOTIT ISA  
BACNOTAN, LA UNION



View of the scrubber. The lower left is a partial view of the cyclone, a sub-unit of the scrubber which collects dust and ash particles from the gas formed in the reactor. The gas then passes through a water filter (right portion of the scrubber). Note the plexiglass cover which gives the user inside view. The water filters other impurities before the gas enters the demister. In working condition.

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