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Report of the Terminal Evaluation

Of the

UNDP

Global Environment Facility

Photovoltaic Project for

Household and Community Use

in Zimbabwe

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Contents

List of Abbreviations

Executive Summary

Part A: Review of Current Project Concept

- | | |
|---------------------------------|---|
| 1. Background | 1 |
| 2. Objectives of the Evaluation | 3 |
| 3. The Terms of Reference | 3 |
| 4. Evaluation Area | 4 |
| 5. Evaluation Methodology | 4 |

Part B: Review of Current Project Concept

- | | |
|---------------------------------------|----|
| 6. Project Objectives | 6 |
| 7. Project Strategy | 7 |
| 7.1 Introduction | 7 |
| 7.2 Equipment Procurement | 7 |
| 7.3 Target Areas | 8 |
| 7.4 The Delivery Modes | 8 |
| 7.5 The Financial Scheme | 12 |
| 7.6 The Credit Support Facility | 12 |
| 7.7 Private Sector Participation | 14 |
| 7.8 Training and Technical Assistance | 14 |
| 7.9 Quality Control | 14 |
| 7.10 Code of Ethics | 15 |
| 7.11 Publicity | 16 |
| 7.12 Implementation Arrangements | 16 |
| 7.13 Sustainability/Capacity Building | 18 |
| 7.14 Special Considerations | 18 |

Part C: Project Implementation and Outputs

- | | |
|-----------------------------------|----|
| 8. Outputs and Activities | 21 |
| 9. Project Implementation | 32 |
| 10. Project Objective Achievement | 33 |
| 11. Systems Quality | 35 |
| 12. Solar Uses | 35 |
| 13. Significance of Project | 35 |

Part D: Lessons Learnt

- | | |
|--------------------|----|
| 14. Lessons Learnt | 38 |
|--------------------|----|

Part E: Recommendations

- | | |
|---------------------|----|
| 15. Recommendations | 41 |
|---------------------|----|

Contents

Part F: Appendices

47

- A: AFC Memorandum of Understanding
- B: ZESA Memorandum of Understanding
- C: BUN Memorandum of Understanding
- D: Southern Centre Memorandum of Understanding
- E: AFC CSF Income/Expenditure Statements
- F: AFC CSF Balance Sheet Statements
- G: AFC Loan Application and Granting Data
- H: PMU Disbursements Data

List of Abbreviations

AC	Alternating Current
AFC	Agricultural Finance Corporation
BUN	Biomass Users' Network
CBO	Community based organisation
CSF	Credit Support Facility
DDSMS	UN Department of Development Support and Management Services
DoE	Department of Energy
EC	Executive Committee
GEF	Global Environment Facility
GHG	Greenhouse gases
GoZ	Government of the Republic of Zimbabwe
IBRD	International Bank for Reconstruction and Development ("The World Bank")
IET	Independent Evaluation Team
IPP	Independent Power Produce
MoTE	Ministry of Transport and Energy
MoU	Memorandum of Understanding
MTS	Master Time Schedule
NGO	Non-governmental organisation
NPM	National Project Manager
NSC	National Steering Committee
ORAP	Organisation of Rural Associations for Progress
PMU	Project Management Unit
PV	Photovoltaic
RE	Rural Electrification
SAZ	Standards Association of Zimbabwe
SEIAZ	Solar Energy Industry Association of Zimbabwe
SIRDC	Scientific and Industrial Research and Development Council
STAP	Scientific and Technical Advisory Panel
TOR	Terms of Reference
UN	United Nations
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
W	Watt
ZESA	Zimbabwe Electricity Supply Authority

EXECUTIVE SUMMARY

1. Introduction

The Consultant was engaged in early October 1997 to carry out a terminal evaluation of the project. The evaluation was carried out over a period of three weeks and involved literature reviews, interviews with personnel from stakeholder organisations and limited visits to PV installations.

2. Project Outputs

The major findings were that;

- a) Project management was weakened by the non-articulation of an explicit project strategy, a task which was supposed to have been actioned by management consultants.
- b) The broad objectives of the project were met, except that the level of awareness of the project could not be gauged, the outreach program does not seem to have worked well and no technology transfer strategy was formulated.
- c) The commercial mode took off very well, with ZESA and NGO modes coming in late. The CBO mode never took off.
- d) CBO mode never took off.

The ZESA mode is probably going to be the most sustainable with the utility using Rural Electrification Levy funds for PV installations.

3. Lessons Learnt

Major lessons learnt include;

- a) There is need for explicit strategising when managing projects involving a high degree of uncertainty.
- b) Sufficient time must be allocated to the process of project formulation in order to minimise dislocations during execution.
- c) During introduction of nascent technologies, such as renewable energy technologies, a key task is the technology transfer task that must be addressed explicitly.

4. Recommendations

The evaluation team's recommendations cover the following areas;

- a) The pilot phase of the project to be terminated at the end of 1997, with a maximum of 6 months allowed for project wind-down.
- b) PMU reverts to DOE after project termination.
- c) The AFC CSF to escalate lending rates toward 0 - 2% real and remain in place to
 - i) manage loan portfolio
 - ii) finance commercial mode end-users
 - iii) finance industry's working and long term capital needs.
- d) Needs of the low income sector to be addressed in the short term by the mobilisation of urban dollars to service rural needs. In the long term PV to be incorporated into rural development plans.
- e) The task of improving local PV hardware manufacturing capacity to be re-visited as a project under the World Solar Programme.
- f) SIRDC to take over small systems R & D.
- g) PMU to carry out a survey to gauge extent of awareness of PV technology and the GEF project nation wide.
- h) ZESA to use Rural Electrification Levy and other concessional funding to deliver PV systems.
- i) The commercial mode to remain in place to service purchase-on-terms customers.
- j) PMU to evaluate NGO mode after sufficient number of systems have been installed.

Conclusion

By and large the project has delivered on its main objectives. Remedial work needs to be carried out with regard to capacity building, definition of the needs of the rural customer and measurement of the level of awareness of the PV technology and the GEF project.

Part A: Introduction

1. Background

The United Nations Development Programme (UNDP) sponsors the "Global Environment Facility (GEF) Photovoltaic (PV) Project for Household and Community Use in Zimbabwe". The project was launched, in 1993 as project ZIM/92/G31/50/99, to "strike a balance between development and environmental concerns by using a sustainable model of solar electricity dissemination in Zimbabwe's rural areas, to address the issue of greenhouse gas (GHG) emissions and global warming".

The broad objectives of the project are to:

- Support the widespread use of solar electric installations as an alternative to grid extension and diesel generators for household and community applications in rural Zimbabwe, through support of, and collaboration with, the private sector, non-governmental organisations (NGOs), community-based organisations (CBOs) and the Zimbabwe Electricity Supply Authority (ZESA).
- Make PV components more readily available on the local market through the bulk procurement by UNDP from the international markets, duty free and tax free, of PV components for resale to local companies in Zimbabwe dollars.
- Improve on the extent and sustainability of local capacity for the manufacture of PV components and the installation and maintenance of PV systems.
- Develop an expanded commercial market in rural areas for affordable domestic solar electric lighting systems by improving the access of householders, in particular the rural poor, to such technology through appropriate financing schemes.

The project was approved in 1992 with GEF funding and execution by the United Nations Department of Development Support and Management Services (DDSMS) in New York, USA. The project document was signed in September 1992, with the National Project Manager appointed in February 1993 and the Rural PV specialist in April 1993.

At the first Tripartite Review Meeting in February 1994, in Harare, it was decided that a change in execution modality from external (DDSMS, New York, USA) to national (Department of Energy (DoE) Harare, Zimbabwe) was necessary in order to improve on the efficiency of project management.

An international Independent Evaluation Team (IET) of consultants was convened by the UNDP/GEF Executive Co-ordinator to conduct an independent review of the project and make recommendations regarding the proposed change in execution modality. At their exit briefing on 14th July 1994, and in their final report of 17th September 1994, the IET recommended, *inter alia*, that the UNDP Country Office and the Government of Zimbabwe (GoZ) submit a formal proposal to the UNDP/GEF Executive Co-ordinator requesting a change in execution modality. This proposal was received from the UNDP Resident Representative, Harare, on 4th January 1995.

An independent review took place on 2nd February 1995; its conclusions and recommendations were presented in the UNDP/GEF memorandum *Change in Execution Modality and Reformulation of Zimbabwe GEF Photovoltaics Project*. The project then changed to national execution modality through DoE at the Ministry of Transport and Energy (MoTE). The project has proceeded on this basis to date.

On the 3rd of September 1997, MoTE sent out an invitation to tender for the terminal evaluation of the GEF Project.

2. Objective of the Evaluation

The main objectives of the evaluation is to:

- ◆ Review the ZIM/UNDP/GEF Solar project in terms of the set objectives
- ◆ Identify opportunities/challenges that could be met through a comprehensive solar energy programme
- ◆ Recommend a programme for wider and more sustainable use of solar energy, such as the World Solar Programme

3. The Terms of Reference (TORs)

TORs of the evaluation were:

3.1 Review the current project concept, design and execution modality with special emphasis on the following:

1. Major project objectives and methodological approach
2. Project beneficiaries and potential end-users, as per Project Document
3. Objectives and outputs stated explicitly, including the environmental impact of the project, sustainability and capacity building
4. Were the objectives achievable and was the relationship between the objectives, the outputs, the activities and the inputs clear, logical and commensurate, given the time and resources available

3.2 Review the project implementation procedures with emphasis on:

1. Quantity and timeliness of inputs
2. Quantity and timeliness of the activities
3. Quantity and timeliness of the project management's responses to change in the project's environment
4. Quantity and timeliness of monitoring and backstopping of interested parties to project implementation

3.3 Assess the project's outputs:

1. Has the project produced its outputs effectively and efficiently?
2. Assess the quality of the installations

3. In what ways is "solar" being used?
4. Has the project achieved its objectives?
5. What is the significance of the project's achievements for the country or region?

3.4 Reviewing and recording the lessons learnt from the project.

3.5 Making recommendations and justifications.

4. Evaluation Area

The evaluation generally covered the whole of the Zimbabwean experience with the project. However, because of the limitation of time, only a few installations were visited and assessed for quality of workmanship, the manner in which solar energy is being utilised and end-users' perspectives on the GEF project.

5. Evaluation Methodology

The Evaluation Team will use broadly three approaches to accumulate the data to be analysed in order to address TOR items:

- ◆ A review of relevant literature
- ◆ Interviews with personnel from the project's stakeholder organisations
- ◆ Visits to selected installation sites

**Part B:
Review of Current Project Concept**

6. Project Objectives

The project's broad development objective was stated as:

"To supply basic electrical services to rural populations lacking access to grid extension utilising an environmentally benign and affordable solar technology, thus reducing emissions of greenhouse gases by at least 3000 tonnes over the five year period as the use of conventional coal-powered electrical generation is deferred and the domestic consumption of paraffin is significantly reduced. The programme will serve as a demonstration of an innovative and still unproven technical approach as an alternative to planned grid extensions."

The project's immediate objectives, in support of the above broad objectives, were:

- ◆ Upon completion of the project, to have developed and proven feasible, a sustainable solar rural electrification strategy with appropriate institutional mechanisms.
- ◆ Over a three-year period, to have facilitated the installation of a minimum of 9000 45W or equivalent solar electric systems in households and community institutions in rural areas, through a revolving fund mechanism which will continue to operate after project end.
- ◆ By the end of the project, to have established standards and upgraded local installation and manufacturing capacity. Improved technological capacity within the local solar industry should be imparted for the manufacture of charge controllers, batteries, lights, low cost (5-10W) systems, battery charging stations and assembly of PV modules.
- ◆ To have created a lasting public awareness regarding the appropriate utilisation of solar electric technology and the benefits associated with it.
- ◆ To have established a self-sustained financial mechanism for funding of solar PV usage and expansion using three delivery modes:
 1. Commercial/private sector
 2. Zimbabwe Electricity Supply Authority , ZESA/utility and
 3. Non-governmental Organisations (NGOs) and Community-based Organisations (CBOs).

7 Project Strategy

7.1 Introduction

A basic objective of the project was to demonstrate an innovative and still unproven technical approach to the large-scale dissemination and adoption of a proven, innovative and renewable technology. In order to address the issues of long-run cost-effectiveness and sustainability of PV-based rural electrification, the project would utilise, as far as possible, existing commercial sector delivery infrastructure.

Strategy elements include:

- ◆ Bulk procurement of PV hardware for use in the project
- ◆ Identification of target project beneficiaries and potential end-users
- ◆ Definition and facilitation of three PV technology delivery modes
- ◆ Setting up of financial scheme for end-users and PV technology dealers
- ◆ Facilitation of private sector participation
- ◆ Training and technical assistance for the local PV industry
- ◆ Quality control mechanisms
- ◆ Development of a code of ethics for the project
- ◆ The mounting of an awareness campaign
- ◆ The definition and installation of implementation structures
- ◆ The development and operationalisation of an industry sustainability and capacity building strategy

7.2 Equipment Procurement

The project takes advantage of the relaxation, under the Economic Structural Adjustment Program, of import controls to establish procurement mechanisms and a credit facility to make available critical inputs to local PV companies. Economies of scale resulting from the bulk procurement of duty free PV hardware required for the production of solar electric systems are to result in savings that could be passed on to the end-user via the installer.

The hardware being procured through tenders conforming with UNDP rules regulations and procedures, would include:

- ◆ Batteries, charge controllers, wiring and switches
- ◆ Solar cells, aluminium, low iron glass and tedlar plastic sheet for manufacturing
- ◆ Finished modules and complete systems for independent suppliers

Following the waiver of customs duty and the import surcharge, the National Project Manager (NPM) and the Solar Energy Industry Association of Zimbabwe (SEIAZ) have pursued a further reduction or outright elimination of selective import duties and sales tax on all imported solar hardware. This endeavour was in line with stated MoTE policy that seeks to "reduce the restriction that tax and duty place on the access lower income rural people have to this technology." *The willingness of the*

Ministry to expedite this issue, however, may have been tempered by the pressures on the government to maximise revenue collection in order to balance the national budget.

7.3 Target Areas

Criteria for selecting project beneficiaries were to be based on geographical and economic consideration and were to include:

- ◆ Located more than 25km from an urban centre, or more than 5km from the electrical grid. *This criterion, while assisting in the shift of developmental focus from the urban to the rural areas, does not address the fact that greenhouse gas-emitting candles and kerosene lamps are in use in unelectrified urban households. In fact in countries like Botswana PV electric lighting is in widespread use in urban areas. Further, the distance-from-the-grid criterion is not really valid without specifying the transmission voltage of that particular portion of the grid. For financial reasons flowing from the technical considerations involved in the stepping down of grid voltages to the AC mains level, a rural householder living directly underneath a 330kV line may as well be 1000km from the grid. For most rural householders the cost of stepping down from 33kV or even 11kV is prohibitive.*
- ◆ Income levels (a ceiling to be established for eligibility)
- ◆ Source of income (civil service, farming, business, etc), to determine period and method of payment.

A systems distribution pattern by end-user classification was proposed, with a proviso to adjust accordingly should actual off-take patterns require this.

7.4 The Delivery Modes

Individuals/households and institutions are eligible to any of the three delivery modes according to income levels and other criteria, with conditions in each category the same for all qualifying customers serviced by each mode.

The marketing strategies and funding mechanism were to be developed with the assistance of PMU and commissioned after approval by the Executive Committee (EC).

7.4.1 The Very Low Income People

The project realised the need to address the specific requirements of the potentially large market for small lighting systems (5-20W), since the very low income people (perhaps 80% of the rural population) do not have the purchasing power and cannot access commercial lending, not even at a concessional rate.

This sector also includes a sub-group of special concern to the UNDP – women. Because men tend to migrate to the cities seeking employment, women outnumber men 10-7 in the rural areas. Women are likely to benefit the most from the penetration of PV technology into the rural areas. They are the ones who usually

stay at the villages conducting domestic and productive tasks, are subjected to workloads of up to 18 hours a day and after sunset are confined to dark workplaces where they are unable to enjoy quality time with their families. For this reason they are often the first ones to show interest in solar lighting.

Because the project could be instrumental in enhancing the living conditions of rural women, it was intended that women's organisations at the national, provincial and district level would be encouraged to become involved in the programme.

To construct specifically tailored approaches necessary to reach this sector, the PMU was to conduct an effective outreach program to identify the sector's desired services, specifications and the prices for the required PV products as well as provide the information on the basis of which the basis for payment will be established.

It was envisaged that ZESA, the NGOs and CBOs would play a lead part in servicing this sector.

7.4.2 The ZESA/Utility Mode

This mode was seen as attractive for the servicing of the very low-income sector because ZESA is a large organisation that can accommodate long term financing arrangements. Such arrangements could result in the amortisation of the cost of household systems over, say 10-20 years, bringing the monthly payments down to a level poor people could afford. Some options available to ZESA were seen as:

- ◆ Rental/leasing and purchase of systems on a long-term basis
- ◆ Utilisation of battery charging stations owned and operated by ZESA and accessible to users through a small monthly fee
- ◆ Payment in kind (eg installation labour)

One has to anticipate a problem with the provision by ZESA of small systems such as magic lanterns and DIY kits on a basis other than outright cash purchase. These systems are highly mobile, making it difficult to enforce payment from a defaulting low-income rural customer with no negotiable assets. Perhaps a way out of the dilemma would be for ZESA to target stable, employed customers in urban or rural areas and motivate them to purchase these small systems on behalf of their dependants back at the village. Credit can then be controlled in the usual way, including ZESA AC mains disconnection where applicable.

Because of ZESA's ability to tolerate perpetual lease type payback cashflows, the possibility exists here for the customer to pay monthly, quarterly, semi-annually or annually. Annual payments would be particularly suitable for a customer whose cashflow is driven by seasonal agricultural activities.

With respect to the option of ZESA owned and operated battery charging stations, experience in other countries suggests that there is a danger of acid spillage, for both humans and the environment, during battery transportation to and from the charging stations. In Africa in particular it is likely that women and children would be made responsible for the transportation task, with women generally inclined to carrying any load on their heads. A safe and affordable transportation procedure would have to be used that does not involve

child labour nor cause more hardship for the rural we on eg pull trolleys, scotch carts, bicycles (with suitable protection against acid spillage).

Further analysis indicates that ZESA is well placed to be a major disseminator of PV technology in the rural areas. ZESA has the statutory mandate to provide electrical energy to the nation. Their mission statement refers to their commitment to the total electrification of Zimbabwe at World-Class standards. ZESA already has a Rural Electrification (RE) Master Plan and associated structures and resources in place. The RE effort had initially focussed on extensions of the grid to unelectrified centres. This effort came to a halt when it became clear that the very low energy usage levels of the average rural consumer were such as to make it difficult if not impossible to recoup the high capital outlays associated with the construction of long transmission lines to centres distant from the grid.

ZESA has since, with the blessing of the government, imposed a 1% Rural Electrification levy on all its customers. The resultant so-called Rural Electrification fund is available to finance the RE effort, be it by conventional grid extension where this is deemed viable but also by renewable technologies such as solar PV systems. At the time of reporting, the RE Levy was reported to have accumulated about Z\$100m, of which Z\$56m is not committed.

Proposals have also been made to incorporate into the latest revision of the ZESA Act a Producer's Levy whereby the producers, including ZESA and any Independent Power Producers (IPPs) would match the consumer dollar-for-dollar in contributions to the RE Fund. If, in addition, other funds are made to ZESA on a concessional basis, it is obvious that the ZESA mode of delivery could be highly sustainable.

Also in favour of this mode is the fact that ZESA have the expertise to design systems and enforce installation standards. Current policy thrust acknowledges that ZESA is not in the construction business and would prefer to contract out installation work, including that of PV systems. ZESA has the geographical reach in Zimbabwe as a whole to ensure that quality after-sales service will always be available to the end-user.

Because ZESA could eventually bulk purchase PV hardware with economies-of-scale savings it could consider advancing this hardware to the installation tender winners, thus helping to address the latter's working capital constraints. After the installation has been inspected and passed, the installer would be paid for the cost of the installation less the hardware costs. In fact, the tenders could be for the installation costs only if it is explicitly understood that ZESA would always supply the hardware. The issue of the installer's access to long term capital would still need to be addressed.

From the foregoing, it is clear that this mode can meet the needs of all stakeholders:

- ◆ ZESA will satisfy their electrification mandate
- ◆ PV installation companies will participate in ZESA construction tenders
- ◆ PV hardware companies will participate in ZESA's hardware supply tenders
- ◆ PV installation companies' working capital needs will be addressed by ZESA hardware advances and
- ◆ The customer will have access to quality installations and good after-sales service through flexible financing mechanisms.

7.4.3 The NGO/CBO Mode

This was the other mode seen as servicing the needs of the rural poor. It was intended to involve providing access to PV hardware to NGOs and CBOs (examples of the latter are rural district councils, provincial development councils and local solar energy credit associations) for dissemination through their own satellite funding systems. In order to cut delivery costs, PMU were to train NGO/CBO personnel and assist the latter in training their own members at grass roots level on system installation and maintenance. The larger portion of the savings so realised was to be passed on to the end-user.

The NGOs and CBOs were to act as intermediaries between the end-users and the AFC, distributing credit application forms, collecting end-user down payments and instalments.

The project had not anticipated that units of Local Government, such as the Rural District Councils and Provincial Development Committees, lack the statutory capacity to borrow and thus cannot operate satellite funding systems on behalf of the project. So the only CBO that could have come on board would be some kind of a Solar Credit Co-operative

With this delivery mode it is conceptually possible to deliver the free-standing and DIY systems since each individual would remain financially responsible to the AFC and his/her system would be the collateral for the loan. In the event of a customer defaulting on loan repayments, the AFC is statutorily empowered by its Act to confiscate any property of the client – eg cattle, ploughing equipment, crop harvests etc – in order to induce the customer to pay. Being an agricultural institution, AFC are already familiar with repayment systems that are driven by the seasonality of agricultural activities.

Major advantages of having the AFC as the responsible financier are the fact that they have the geographical penetration into the rural areas and are familiar with the ways of the rural customer, unlike any of the commercial banks.

Of major concern for the post-pilot era would be the area of enforcement of installation standards (whose employees will the installation inspectors be?) and the provision of after-sales service.

7.4.4 The Commercial Mode

Under this modality, individuals/households as well as community institutions with a higher purchasing power would be served. Credit application forms for this mode are available from a variety of sources (AFC, installers and the Provincial Councils), but with the main marketing effort being undertaken by the installing companies. This did not preclude other organisations, including ZESA, NGOs and CBOs from conducting their own marketing efforts. Based on the eligibility criteria set by the Advisory board, AFC would process applications. Conditions for this modality were to be determined by those prevailing in the market-place which represents – on its own – a strong sustainability fund (the Credit Support Facility or CSF) since the bulk of the systems were expected to be delivered through this mode.

7.5 The Financing Scheme

It was intended that three basic financing modalities would be put in place:

- ◆ Dealer financing for aggregate loans through block discounts involving multiple consumers handled by PV suppliers/installers, NGOs and CBOs. *This scheme could never have been fully implemented as UNDP regulations do not allow lending to profit making companies, even though support can be given in the form of technical assistance. Lending to these companies could, however, have been effected through the UNDP's sister organisation UNIDO. Thus without a replacement financing mechanism, from the onset this project could not address the industry's working and long-term capital needs.*
- ◆ Individual consumer financing for solar systems using the solar panel as collateral
- ◆ Loans to institutions and community associations backed by a loan guarantee from the programme fund.

The AFC was be the first organisation to provide credit for the nation-wide dissemination of PV technology. A Credit Support Fund is in place at AFC with project funds for the commercial delivery mode. This facility was to be extended to cater for the for the NGO/CBO mode.

7.6 The Credit Support Fund (CSF)

The PV technology adoption rate during the course of the project was going to be a function of the establishment of locally supported and funded financing schemes for both the end-users and systems supplier/installer. The CSF, established with initial seeding from the project, was expected to consolidate this scheme.

An appropriate legal framework was established for the operation of the CSF at the AFC before change to national execution mode. Similar arrangements were to be made, with ZESA, NGOs and CBOs, by PMU who also developed appropriate management procedures and financial regulations.

The soundness of the management of the AFC CSF was going to be a key determinant of the success of the project. After the successful credit vetting of the prospective client by AFC and the installer's system design by the PMU, the following would occur in sequence:

- 1 Client pays 15% of installation costs as a deposit to AFC
- 2 Installer obtains invoice with price of hardware from PMU
- 3 Installer proceeds to AFC to pay and obtain an AFC receipt
- 4 Installer presents AFC receipt to PMU and receives the PV hardware for the installation.
- 5 System installation proceeds
- 6 On completion of installation a Completion of Work (CoW) form is issued.

- 7 If installation is on the PMU inspectors' random sampling plan, it is inspected
- 8 Any faults noted by the inspectors are rectified
- 9 Installation is passed by the inspectors
- 10 On presentation of inspectors' certificate, installer is paid installation costs (less hardware costs)
- 11 Client starts paying instalments to AFC calculated on the basis of an interest rate of 15% over 3 years.

From the foregoing, it follows that the inflows into the fund are composed of:

- ◆ The initial seeding to jump start the fund
- ◆ Clients' 15% deposits
- ◆ Installer payments for PV hardware from PMU warehouse
- ◆ Clients instalment payments
- ◆ Interest earned on investment of excess funds on the money market

Outflows from the fund are composed of:

- ◆ Payment of installation costs to installers
- ◆ Payment defaults

Factors affecting the sustainability and stability of the fund are

- ◆ The fact that the 15% rate on the end-user loan is negative in real terms
- ◆ The fund pays the installer the full installation costs after receiving only the hardware component of the full cost from the installer, then waits for the client to contribute towards the funding gap over a period of 3 years
- ◆ Zimbabwe dollar depreciation during the delay between arrival of PV hardware and hardware draw down by the installer.

The AFC Loan Terms are as follows:

- ◆ \$30.00 application fee for individuals and \$100.00 for companies
- ◆ 15% deposit (minimum) by end-user
- ◆ 15% per annum interest composed as follows:
 - 7% (on disbursements) AFC administration fee
 - 3% Stabilisation fund to provide cover against defaults
 - 3.5% contribution to finance scheme's capital base (to increase funds available for disbursement from the scheme)
 - 1.5% Mortgage protection scheme (self insurance cover)

Mechanisms were to be put in place to retrieve from cash payments for installations, the contribution to the capital base that is built into the interest rate of the financial scheme.

7.7 Private Sector Participation

7.7.1 General

To meet the goal of the programme, the participation of most of the private sector companies was required. The commercial mode was expected to install >90% of the systems. The target of 9000 systems implied an installation rate of 15-20 systems a day for at least 200 days/year for 3 years, much greater than the 6-10 systems/day in early 1995.

Key to the long-term sustainability of the project are:

- ◆ Local private sector capacity for system installation, maintenance and repair.
- ◆ Creation of mechanisms for financing PV system supply (*More explicitly, this should have addressed both working and long-term capital*)
- ◆ Creation of mechanisms for financing PV system demand (i.e. end-user)

7.7.2 Co-ordination with Industry

The stated strategy involves closer links between PMU and participating companies, promotion of local component manufacture, establishment of joint committees and holding of regular sessions, as well as hosting of de-centralised workshops and training programmes

7.8 Training and Technical Assistance

The prodoc refers to the intended development of an articulate strategy for strengthening the local solar technology know-how. The strategy would be operationalised through a detailed medium-term capacity building workplan prepared by PMU. A deliberate effort would be made to exploit technology transfer possibilities, with the project becoming a major catalyst for technology transfer by facilitating links between local solar companies and international solar experts. There are provisions for short-term consultancy services by experts of the highest calibre and for study trips to other countries with more advanced PV technology. In conjunction with the relevant institutions, PMU was to establish training courses for qualified installation applicants. Conducted by professional PV systems trainers, these courses were to be a prerequisite for certification and licensing of installers and technicians. Other forms of training for installers and end-users were to be undertaken on a systematic basis and included in the workplan.

7.9 Quality Control

7.9.1 Qualifying Criteria and Standards

Building up of local industry capacity to improve technical capabilities and reduce system failure was perceived as key to project success. Like-wise, monitoring mechanisms are essential for long term quality and market sustainability. Thus PMU and industry developed a set of criteria and procedures for certification and licensing of installers and technicians. To ensure transparency in the certification of installers,

clear, technical, professional and financial criteria to be met by all firms before they could participate in the GEF project were established.

Uniform and transparent guidelines for evaluation and qualification were applied. In order to facilitate free entry, qualifying criteria were to be perceived not as a set of pre-conditions but as capacity areas to be assessed and supported if found wanting. The PMU were to make every effort to accommodate requests for technical assistance and training from firms/institutions which required such support in order to meet the criteria.

7.9.2 Testing Equipment.

Notwithstanding that the equipment to be purchased was to be of the highest international quality standard, suitable technical facilities were to be provided to PMU for the purpose of performing basic testing to ensure that out-of-the-box equipment will be in working order, thus eliminating from the installers the risk of manufacturer faults.

7.9.3 Inspections.

A system of inspections was to be the backbone of the quality control strategy. Based on a random sampling approach, regular inspections were to aim at ensuring a high level of quality in installations and service and full adherence to the standards by the installers. Relying on existing national institutions for its operation, PMU were to devise a sustainable system of inspections which was to take into consideration the company's experience in the field and past performance. The inspection costs, essentially transport and per-diem, were included in the project budget under the travel costs line. Costs for re-inspections due to faulty installations were to be for the installer's account.

7.9.4 Warranty and Maintenance.

As in most cases the PV systems would need service and repair within three years of installation, installers were required to offer at least a three-year warranty, the projected cost of which could be incorporated into the initial installation price or offered in the form of an extended service contract to the consumers.

Special arrangements were to be made for the NGO/CBO modes in which, as a cost cutting measure, trained beneficiaries would be responsible for installation and maintenance.

Upon satisfactory completion of installation, both installer and end-user were to certify that the latter had been trained on the use and simple maintenance of the equipment, before the certificate of completion is issued by the PMU.

7.10 Code of Ethics

A clear set of standards for ethical and professional behaviour developed for the industry by the PMU has been approved by the EC. This includes guidelines for

resolution of conflicts of interest and penalties for these. Provisions should include, for example, ensuring that GoZ/UNDP employees do not:

- ◆ Misuse their positions
- ◆ Communicate, without authority from GoZ/UNDP, any privileged information
- ◆ Establish their own solar installation and/or service companies

Companies benefiting from the project should meet basic standards of professional competence, financial responsibility and good ethics.

7.11 Publicity

Publicity arrangements involve the dissemination of project progress information via a newsletter prepared and published by the PMU in collaboration with project stakeholders. A video documentary of the project's progress was targeted for publication in time for the 1995 World Solar Congress of the International Solar Energy Society in Harare. Provisions were also made for PMU to participate at trade fairs, shows, expositions etc.

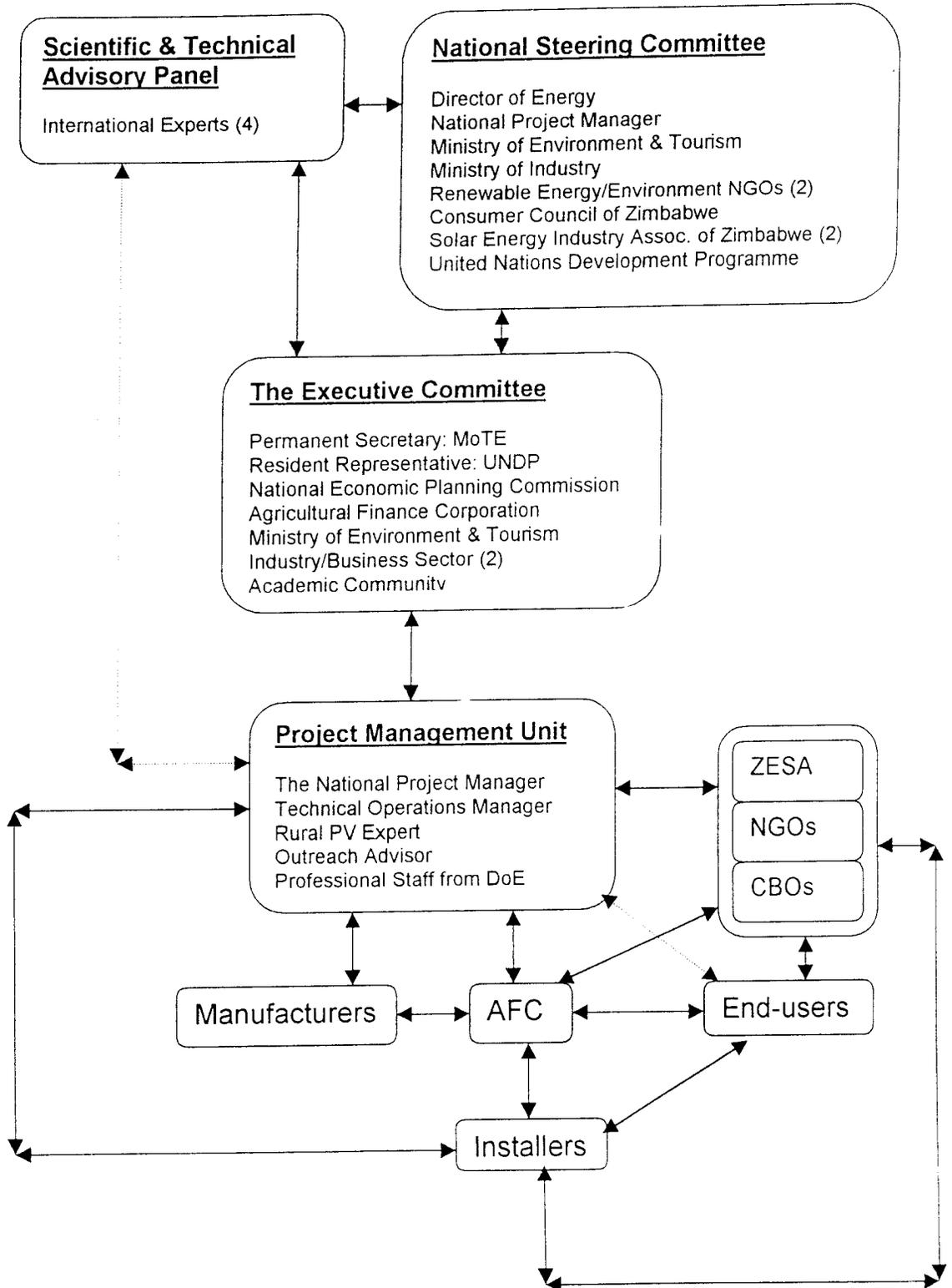
7.12 Implementation Arrangements

Four bodies were set up to help manage project execution (see next page):

1. The Project Management Unit (PMU) administers and controls the operations of the project on a day to day basis. Its National Project Manager (NPM) is responsible for the co-ordination of the project which is run on a day to day basis by the Technical Operations Officer. The mandate of the Rural PV expert was to provide the high level of technical input required for elements of the project, such as training and capacity building. The Outreach Advisor's task is to prepare and put in operation an effective outreach programme for the low-income peasant population.
2. The Executive Committee (EC) is the highest executive body of the project, responsible for overall project guidance on operational and managerial issues.
3. The National Steering Committee (NSC) advises the GoZ on policy issues including target areas, allocation of systems amongst delivery modes, participation of additional financial entities in the Credit Support Facility etc.
4. The Scientific and Technical Advisory Panel (STAP) provides technical backstopping and oversight.

In the opinion of the Consultants, the project's organisational structure could have been simplified, with the PMU reporting to a single Project Board of Directors composed of:

The Main Project Participants



- 8 *Permanent Secretary, MoTE, with the Director of Energy as his alternate*
- 9 *UNDP Resident Representative and a nominated alternate*
- 10 *Agricultural Finance Corporation*
- 11 *Commercial delivery mode (SEIAZ President)*
- 12 *Utility delivery mode (ZESA General Manager)*
- 13 *NGO/CBO delivery mode*
- 14 *The Standards Association of Zimbabwe*
- 15 *National Project Manager*

The mandate of the Project Board would be to:

- ◆ *Impose management discipline on the PMU*
- ◆ *Manage the project control loop*
- ◆ *Articulate or develop policy positions or guidelines as relevant*
- ◆ *Provide managerial and technical backstopping*

The Board would hold regular, scheduled meetings, initially on a monthly basis during the first quarter, then quarterly thereafter. The meetings would be co-chaired or alternately chaired by the UNDP Resident Representative and the MoTE Permanent Secretary or their alternates. The Permanent Secretary, MoTE, would be responsible for all the necessary intra-governmental liaison for the development and/or articulation of policy positions and guidelines. The international PV experts would attend the meetings as and when their presence was required and requested. All Board members to receive minutes of meetings and provide timely feedback as indicated in the minutes.

The advantage of including utility and NGO CBO delivery mode representatives is obvious – the expediting of the task of bringing those modes on board.

Because the project organisation structure was so complicated, very clear terms of reference for each component would have had to be formulated and efficiently disseminated. It is possible that it is this lack of clear definition of project component interfacing procedures that led to communication problems evolving towards the end of the project.

7.13 Sustainability/Capacity Building

PMU was to delineate a medium term workplan with specific targets for technical assistance. The strategy was to have three main elements as discussed below:

7.13.1 Human resources development

PMU staff were to be trained in the management of the Credit Support Facility, and technically through study trips aboard and participation in workshops.

Other activities were to include technical, entrepreneurship and management training as well as technical assistance for the industry, and end-user training in basic maintenance. Steps were to be taken to introduce PV technology in the curricula of institutions of higher learning.

7.13.2 Institutional building/strengthening.

A management consultant was to be engaged to assist the PMU in the construction and implementation of systems, structures and procedures designed to enhance its capabilities.

PMU was to be provided with resources for conducting basic equipment testing.

The project was to assist in consolidating local private sector capability for installation, operation, maintenance and repair of PV systems. Areas of focus were to include the provision of finance to installation companies and end-users, development of standards and quality control systems to ensure the technical integrity of installations.

7.13.3 Creating an appropriate policy environment

For consideration was:

- ◆ Collaboration with ZESA in the development, financing and implementation of the Rural Electrification Master Plan
- ◆ Integration of outreach activities with GoZ social and economic programmes and co-ordination with multilateral development assistance.
- ◆ Negotiation with GoZ for the removal of sales tax from GEF-imported hardware.

7.14 Special Considerations

Areas of special concern for the UNDP are women (see #2.4.1 above, and the environment.

The shift from use of kerosene lamps to PV systems implies the foregoing of the emission of perhaps 40 tons of carbon dioxide into the air per 1000 households per annum. The project would decrease demand for dry cell batteries that would otherwise poison the environment when dumped after use, as well as stem hydrocarbon emissions from candles.

Part C:
Project Outputs

8 Outputs and Activities

In support of the project's immediate objectives (see #6 above), eight outputs, each supported by a set of activities, were proposed. The outputs were concerned with:

- ◆ Access to technology equipment
- ◆ End-user financing
- ◆ The ZESA delivery mode
- ◆ The NGO/CBO delivery mode
- ◆ Training
- ◆ The Awareness Campaign
- ◆ Improved Local Manufacturing Capacity and
- ◆ Standards

These outputs and their activities are discussed below.

8.1 Access to PV Technology Equipment

8.1.1 Output 1 Statement:

Availability of, and immediate access to, critical PV technology equipment and components for utilisation by Zimbabwe's solar industry to assemble and install 9000 equivalent 45W solar systems in households and community institutions in rural areas, according to the requirements and needs of the end-users.

8.1.2 Output Activities

1. PMU to establish appropriate procurement/storage facilities for solar panels and components, utilising Government and UN established capacity.
2. In co-ordination with the solar industry and the Standards Association of Zimbabwe, the PMU will develop mechanisms, a set of qualifying criteria, and procedures for certification and licensing of installers and technicians as a prerequisite to access the PV equipment purchased by the project.
3. PMU to establish suitable technical facilities for performing basic testing of out-of-the-box equipment. *In support of this activity, there should have been another activity to define the range of tests that were to be carried out. From this range of tests the test hardware could then have been specified with input from the PV expert attached to PMU.*
4. A code of ethics for participating companies to be developed by the PMU and approved by the Executive Committee.

8.1.3 Achievements

The availability and immediate access to critical PV technology was effectively realised through the setting up of a GEF warehouse supplied through bulk procurement of modules by the PMU. As an efficiency measure in the module

procurement process, import duties and surtax was waived by Government but efforts are still underway to secure sales tax exemption on PV systems. In addition, qualifying criteria for installers and technicians were agreed upon with the private sector and through a rudimentary laboratory, solar devices can now be tested. In an effort to enforce good business ethics, a code of conduct for Solar Energy industries Association of Zimbabwe (SEIAZ) has been included in the organisation's constitution.

The equipment draw down procedure at the PMU warehouse is as in #7.6 above.

An unforeseen problem evolved at the PMU warehouse: because of working capital constraints, installation companies were not keen to draw down their hardware needs as soon as the equipment arrived at PMU. The warehouse was therefore inadvertently providing free storage for industry, with the attendant risks of pilferage, damage and foreign exchange losses, in particular as not enough floor space had not been set aside for this function.

8.2 End-user Financing

8.2.1 Output 2 Statement

Availability of commercial credit funds for end-users to purchase up to 9000 45W (or equivalent) solar electric lighting systems over a period of three years.

8.2.2 Output Activities

1. Identification and selection of target areas according to the specified criteria and in consultation with the Provincial District Councils.
2. Establish a three-tiered, self-sustained Credit Support Facility at participating financial entities to provide credit to dealers, individuals and community institutions for the purchase of solar systems. *The fact that UNDP rules do not allow for the financing of profit making entities should have been recognised early so that other arrangements could have been made, through UNIDO for instance, for dealer financing. The issue of long-term capital for the purchase of manufacturing and other equipment is not addressed at all.*
3. Develop and put in place criteria for the selection and qualification of solar electric dealers, NGOs, CBOs and installers as participants in the credit scheme.

8.2.3 Achievements

8.2.3.1 Commercial Mode

Credit funds for end-users were made available through the AFC revolving loan fund for the commercial delivery mode. As at September 30 1997, the AFC had processed 5464 loan applications worth Z\$61.28m and granted 5264 (96.33%) of these, worth Z\$48.86m (80%). The average value of loans granted varied from Z\$6930 in 1993 to Z\$11860 in 1997 (to September 30 1997). The latter figure is

equivalent to about USD1000, considered rather high when elsewhere in the world average system costs are of the order of USD600.

The loan grantings were spread over the AFC's offices as follows:

Karoi/Chinhoyi	Marondera	Bindura	Mutare	Bulawayo	Masvingo	Gokwe/Gweru
17%	13%	9%	18%	5%	30%	9%

It is not known why the Bulawayo office, which presumably deals with all of Matebeleland North and Matebeleland South provinces, would account for only 5% of all loan grantings.

PMU data indicates that during the period from January 1993-September 1997 a total of 3175 Completion of Work (CoW) forms were issued with the following time profile:

Year	1993	1994	1995	1996	1997
Number of CoWs	8	353	970	994	850

This effectively means that 3175 systems were installed during the period. These figures are in obvious conflict with claims that as at the end of September 1997, 7600 systems had been installed. This disparity needs to be explained.

8.2.3.2 The Other Modes

The setting-up of the NGO mode was slow and therefore has been in operation for only 15 months for BUN and ORAP and 10 months for Southern Centre. The CBO mode has not taken off at all. The ZESA mode has just started installations.

8.3 The ZESA Mode

8.3.1 Output 3 Statement

Institutional capacity at ZESA for the dissemination, installation, and maintenance of an initial 700 solar electric lighting systems of 45W equivalent as an alternative electrical system.

8.3.2 Output Activities

1. PMU to assist ZESA in the preparation of a marketing plan and implementation of a dissemination strategy for the delivery of solar electric systems in selected rural areas. *Throughout the document there is frequent mention of PMU assisting in the setting up of strategies for other parties, but no mention is made of the training of PMU staff in marketing planning and strategic management elements as they would relate to a project of this nature.*
2. Institute the appropriate mechanism to expedite the access of ZESA to the equipment and components necessary for the delivery of 700 45W equivalent solar systems to at least three communities of 100-500 houses.

3. Make the appropriate provisions including procedures and regulations for a subsidiary Credit Support Facility at ZESA, to finance ZESA-delivered systems. *It would have been preferable to have had this task attended to at the time that the AFC CSF was put in place, in order that there would have been no delays in bringing this mode on board.*
4. Support ZESA in the establishment of a solar programme including training to appropriate officials and staff.
5. Conduct a terminal technical review of ZESA's emissions to indicate the degree to which GHGs have been offset by attendant grid displacement. *Environmental Impact Assessment is a very new subject in Zimbabwe with few, if any, people qualified to carry out any relevant tests. This task should perhaps have been assigned at project commencement to a specialist consultant, with the requirement for knowledge transfer to a Zimbabwean during the specialist's period of attachment.*

8.3.3 Achievements

The ZESA MoU was signed in 1997. A total of 500, not the originally planned 700 systems, were allocated to ZESA.

In their in-house "Feasibility Study of Solar Utilisation by ZESA", ZESA make the following recommendations:

- ◆ Establishment of a pilot project for the installation of 125 PV systems in each of ZESA's 4 operational areas outside of Harare. The latter, it was felt, can be adequately catered for by the grid.
- ◆ To reduce operational costs a basic threshold of 30 systems within a 30 km radius to be considered.
- ◆ Target groups will be individual households, commercial institutions, schools and clinics, individual and/or groups of farmers.
- ◆ ZESA will carry out the initial installation work in order to train ZESA personnel in installation and maintenance. The balance of projects will be contracted out to the private sector but will be inspected by ZESA for compliance with SAZ standards.
- ◆ Payments by end-users to be effected on monthly, quarterly, half yearly or annually to cater for the seasonalities of incomes of the rural people. Payment to be on a perpetual lease basis as per the schedule below. The perpetual payment incorporates a 3% contribution towards a stabilisation and indemnity fund to cater for bad debts, and \$5,00 per month contribution towards a revolving fund to cater for the replacement of batteries and charge controllers.

System Size	Deposit, Z\$	Monthly Payments
1-2 lights	250	70
3 lights	250	80
4 lights	250	90
5 lights	250	105
6 lights	250	120
7 lights	250	135
8 lights	250	140
9 lights	250	145
9 lights	250	150

- ◆ Members of the local communities to be trained contracted to attend to basic system maintenance. Trainee selection criteria will cover basic educational qualifications and the degree to which one is stably settled in that area. Pensioners to be given first priority. Major faults to be attended to by ZESA.

ZESA have marketed their delivery mode at through schools and agricultural shows. All the 500 systems allocated to the utility are now committed but only a few systems have been installed thus far.

The recommendation that all ZESA systems be delivered on the basis of a perpetual lease basis seems to have emanated from a misinterpretation of the ZESA Act as to whether or not it allows ZESA to sell anything other than just energy. ZESA senior management confirmed however that the Act contains phrases that allow ZESA to engage in the sale of energy-related goods and services. In fact ZESA currently does sell two plate stoves direct to end-user. ZESA's chief executive is also of the opinion that ZESA's PV customer should be give the option of an outright cash purchase of the system and entering into a maintenance agreement with the utility. The option that ZESA is not too keen to pursue is the sale of systems on terms because of the associated credit control difficulties.

ZESA are considering a way tracking the performance of installation companies with a view to providing such information to banks as back up for applications by the companies for working and long term capital

ZESA staff training and solar components were provided by the PMU. This activity is to be undertaken by the Southern Centre for Energy and the Environment.

8.4 The NGO/CBO Mode

8.4.1 Output Statement

A sustainable mechanism for the financing, delivery and maintenance of solar electric systems for poor households and villages through NGOs and CBOs (eg Rural Councils, co-operatives) is in place.

8.4.2 Output 4 Activities

1. Define a set of qualifying criteria for participating organisations. Select a group of NGOs/CBOs to deliver the system in the target areas
2. Prepare and put in operation an effective outreach programme for low-income peasant population that will be conducted by the PMU. This exercise will include an assessment of the desired services, specifications, prices for the desired PV products and will provide the information on the basis of which conditions for payment will be established.
3. With the assistance of the PMU, participating NGOs/CBOs will design and implement a delivery strategy aimed at the poorest segment of the rural population, including cost-cutting provisions such as the development, with the assistance of the PMU, of their own capacity (at the local level) for installation and maintenance of PV systems.
4. Make the appropriate provisions, including procedures and regulations for an NGO/CBO "sub-revolving fund", possibly within the main RF, for the financing of at least 1000 45W equivalent PV electrical systems

8.4.3 Achievements

Due to lack of clear guidelines, the NGO delivery mode MoUs were signed by BUN and ORAP only in August 1996 and by The Southern Centre for Energy and the Environment only in January 1997. The CBO mode has failed to take off, as Rural Councils are not allowed to borrow money and hence could not administer a credit scheme. Sub-revolving funds have been set-up and are working at ORAP and BUN, but repayments to the PMU have not yet started. The NGO mode has been allocated 800 systems by the PMU.

BUN have, as at the end of September 1997, installed 52 systems. The number of systems installed by ORAP is not known and it appears that credit extension is still to taken place at Southern Centre.

It will be necessary to evaluate the success or failure of this mode as installation progresses.

8.5 Training

8.5.1 Output Statement

Development of a sustained local PV technological capacity in terms of number of trained and qualified PV technicians and installers.

8.5.2 Output 5 Activities

1. Assist the local industry in devising and implementing a plan for enhancing their in-house technician training facilities/programmes.
2. Develop and conduct an intensive training programme for technicians and installers to create a critical mass of qualified personnel in the private sector, utilities, NGOs, CBOs, Government institutions and other social organisations.
3. Advocate and effectively support the establishment of formal PV education programmes offering technical level certificates in PV technology in at least one of the vocational education institutions.
4. Support the local institutions in the establishment of certification or licensing procedures and requirements for installers and technicians.
5. Arrange for the Zimbabwe publication and/or distribution of PV technical handbook eg Small Solar Lighting Systems for Africa (by Mark Hankins).
6. Produce PV technology training materials in English and vernacular languages specially adapted to the local conditions and needs

8.5.3 Achievements

PV technological capacity had been developed through training of technicians from solar installing companies, ZESA, ORAP, BUN and Southern Centre. On a long-term basis, Masvingo Technical College, Kwekwe Technical College and Harare Polytechnic will provide courses on PV technology initially in the form of adult education courses, then as part of the regular curriculum. Technicians who attended PMU's courses were provided with a copy each of Mark Hankins' handbook on solar lighting systems. The PMU and SEIAZ have also produced a Zimbabwe Solar Magazine.

8.6 Awareness Campaign

8.6.1 Output Statement

Increase national public awareness of benefits of solar electricity and on the PV project.

8.6.2 Output 6 Activities

1. Conduct a public awareness media campaign for the GEF project, highlighting its goals, benefits and financial scheme.
2. Develop and co-ordinate the distribution of PV information materials through ZESA, participation CBOs, district councils, NGOs, Government agencies and the Ministry of Information, Posts and Telecommunications.

3. Participate in expositions, trade fairs, exhibitions and shows around the country to introduce and demonstrate solar PV technology, and report on progress of GEF project
4. Production of video on the use of solar PV electrical technology in Zimbabwe and the achievements of the project. This documentary is to be released at the 1995 World Solar Congress in Harare.
5. Publication of a monthly newsletter on the project progress and on the dissemination of PV technology in the country.
6. Hold end-of-programme three-day workshop including all involved parties to analyse, critique experience and draft final report (1996).

In order to assess the effectiveness of the awareness campaign, another activity should have focussed on the measurement of the levels of awareness of the technology as the project commenced, and the level of awareness of the technology, and the project itself, towards the end of the project. This is necessary to assess whether the project objective to "create a lasting public awareness" had been met. As it is, it would be difficult to assess how effective the campaign would be, and what could have been done to improve it.

8.6.3 Achievements

Public awareness of the PV project has been achieved to an unknown extent through participation in trade fair exhibitions and agricultural shows, publication of the SEIAZ Newsletter and Zimbabwe Solar Magazine, and through radio and television articles. The outreach efforts have achieved limited success and may therefore need to be continued and intensified.

A documentary video on use of solar PV technology was produced but it was not published in time for showing at the World Solar Summit.

To illustrate the need for the assessment of the level of awareness of the project and the technology in order to gauge the effectiveness of the awareness campaign, five installations in Chishawasha, about 20-30 km outside of Harare, were visited. All of the systems, it turned out, were 22W DIY systems, one of them imported from South Africa. The systems owners were vaguely aware of the GEF project but had acquired their systems after receiving information about the technology by word of mouth. It appears the main source of information about PV technology in that area is a Roman Catholic priest who is very active in renewable energy circles.

One of the systems had been installed because the user was fed up with the rate at which he was having to send for charging, an automotive battery he was using to power his radio and television set. So he installed the PV system just to keep the same battery charged and carried on using kerosene lamps for lighting. He was interested to know that he could acquire a PV lighting system locally and wanted to know where he could get one.

All the systems inspected were bought for cash, they all used automotive batteries, none had charge controllers installed and none used conduiting for wire routing.

8.7 Improved Local Manufacturing Capacity

8.7.1 Output Statement

Improved technological capacity, within local industry, for the manufacturing of charge controllers, batteries, lights, small low-cost (5-10W) systems, battery charging systems and for the assembly of solar PV modules.

8.7.2 Output 7 Activities

1. Prepare and put in operation a medium term capacity building workplan for strengthening local know-how on PV technology. *In the opinion of the Consultants, this was going to be one of the most important activities of the whole project and it was acknowledged in the project document (prodoc) that the specialist PV expert would be necessary to construct and articulate the strategy. A formal project strategy workplan could have afforded this activity the prominence it deserved.*
2. PMU to organise and conduct, in conjunction with the relevant institutions, quarterly training courses for qualified installation applicants by professional PV systems trainers, as prerequisite for certification and licensing of installers and technicians.
3. PMU to organise refresher training courses for installers and end-users on a systematic basis.
4. PMU to devise a sustainable random-sampling inspections strategy which will take into consideration the company's experience in the field and past performance. Inspection to be built in as a cost component of the system but re-inspections due to faulty installation to be borne by the installer.
5. Design and support a research and development programme for the local manufacture of small (5-10W) PV systems.
6. Develop a technology transfer and technical assistance plan to the local industry to be implemented with the PMU's own experts, short-term consultants and other technical specialists as required. *See comment after Activity 1 above.*
7. Organise study tours for personnel of PMU and DoE to observe the experiences of PV technology in other countries. *It would have been a good idea, in the context of private sector capacity building and technology transfer, to include industry engineers under this item.*

8.7.3 Achievements

PMU carried out training of technicians from all new installing companies as part of the certification and licensing of installers. Follow-up on newly trained technicians and sampling techniques were employed for quality assurance purposes.

Study tours of PMU and DOE were undertaken and the project has received international attention. It is perhaps unfortunate that no technology transfer work plan has been developed to assist local industry.

However, the crucial workplan referred to in Activity 1 was never formulated. No new module assembly companies have emerged as a direct result of this project. This would have been a very important component of the overall project strategy which, again, was never formally constructed and articulated.

Due to lack of funds, for plant and machinery, the solar manufacturing base did not expand significantly during the project.

8.8 Standards

8.8.1 Output Statement

To have established standards for PV equipment and components, both locally produced and imported, including a licensing programme for installers and standards for installation and design. On-going testing programme for PV components and systems.

8.8.2 Output 8 Activities

1. Establish systems qualification for component suppliers, and set design and balance-of-systems specifications for two or three systems of sizes agreed upon in consultation with SAZ, industry and the Solar Energy Society.
2. Establish, in co-ordination with industry and the Zimbabwe Standards Association, national standards for PV systems components, modules, installations and maintenance.
3. Prepare and establish testing procedures and programme in association with the Standards Association of Zimbabwe.
4. PMU to establish testing facilities to perform basic testing of imported and locally manufactured equipment and components.
5. PMU to devise and institute an inspection strategy based on random sampling methodologies to ensure that all installations are done in compliance with standards and regulations.

8.8.3 Achievements

The PMU has worked closely with Standards Association of Zimbabwe (SAZ) and SEIAZ and have formulated and published the following:

- ◆ DoE/GEF Interim Solar Photovoltaic System Component and Installation Standards.
- ◆ Draft SAZ Standard for Fluorescent Lights for use in Photovoltaic Systems

- ◆ Draft SAZ Standard Test Method: Batteries for Use in Photovoltaic Systems
- ◆ Draft SAZ Standard Code of Practice for Installation of Battery based Photovoltaic Systems.
- ◆ Draft SAZ Standard Test Method: Charge Controllers for Photovoltaic Systems Using Lead-Acid Batteries.

PMU has established a small laboratory for device tests. It is however observed that the test laboratory is under-equipped. The quality control efforts have been useful as the number of systems failures reported by clients soon after installation has become negligible.

A sampling system for installations inspections is in place.

9 Project Implementation

A major weakness in the management of this project is that even though the need for a goal-oriented workplan was anticipated in the prodoc wherein it was suggested that the services of a management consultancy be acquired for the formulation of such a plan, ***no such plan was ever formally synthesised.***

The services of management consultants Coopers and Lybrand were acquired in 1996. In their Terms of Reference, Item N^o 10 reads:

“Initiate a strategic business plan in order to develop a practical goal oriented work plan.”

As far as the Consultants can determine, no such strategic business plan or “practical goal oriented workplan” was constructed.

Because a technology that is relatively new in Zimbabwe was going to be implemented using a new and as yet unproven approach in a ±Z\$85m project spanning several years, the explicit articulation and documentation of a strategy was important for the purpose of:

- ◆ disseminating that strategy to all interested parties
- ◆ allowing desktop analysis and fine tuning by interested parties
- ◆ highlighting the project’s target milestones on the timeline
- ◆ installation of project control mechanisms
- ◆ enabling the quantification and specification of the project’s resource demands on the timeline and therefore the project’s ability to meet key deadlines.
- ◆ enabling the periodic assessment of project progress by explicitly identifying the benchmarks against which project progress was to be measured
- ◆ enabling corrective action to be taken whenever the project performance was less than satisfactory.

The explicit articulation and documentation of the strategies and sub-strategies that were to be used to attain project objectives, besides forcing the strategist to focus and stay focussed, would have made those approaches available for scrutiny and optimising adjustment by stakeholders. A core component of the business plan would have been a Master Time Schedule (MTS) where all significant project activities would be laid out in time and in their order of logical precedence. Analysis of the MTS for resource demands activity-by-activity would have enabled the construction of the project’s projected total resource demand in time. This would have enabled the identification of instances of resource supply/demand function imbalance, allowing for the taking of pro-active corrective action.

The MTS would also have enabled the highlighting of key project outputs and an assessment of their achievability, given the inputs profile in time and the availability, or lack, of the resources needed in time. Without the MTS there is no formal mechanism for project control which involves measurement of current status,

comparing current and previously projected status and taking the necessary corrective action to eliminate any error between the two.

This problem was evidently recognised by PMU staff in the process of running the project as use of Gantt charts was initiated some time after the project had started. But these charts operated without reference to an articulated strategy and project control mechanism.

Because of this strategy void, the locations of inputs, outputs and monitoring activities were not formally specified on any timeline. There does not seem to have been any explicit time scheduling of any activities, including monitoring activities, at the project formulation stage. It is not even clear that the various in-term reviews/evaluations, such as the ENDA Report, the STAP Report and the Independent Review were scheduled interventions. From the Terms of Reference, it appears that the Coopers and Lybrand review was, at least in part, a reaction to the STAP Report.

Even given that there is no documented basis for objectively assessing the timelines of project inputs, outputs and activities, it is quite obvious that there was a significant delay in bringing the ZESA and NGO modes on board. The NGO Memoranda of Understanding (MoUs) were only signed in August 1996 (ORAP and BUN) and January 1996 (Southern Centre), about 1½ - 2 years after the change in project execution modality to national. The ZESA MoU was signed in April 1997, about 2 years after the change in execution modality. The delays are blamed on the lack of definition of funding mechanisms for these modes, but the relevant activities required for the mechanism definition could have been expedited during the ±7 month dead zone during the changeover from external to national execution.

Although frequent reference is made, in the prodoc, to "approval by the Executive Committee" it appears that to date the EC has met only twice since the change to national project execution in 1995 – the minutes of one meeting are dated 15th November 1995 and the other 9th August 1997. Given that the EC was there to provide managerial oversight to PMU, it would have been prudent for the EC to meet more frequently in order to execute their facilitation mandate, gauge the rate of project implementation progress and initiate corrective action as necessary. The MTS and project control mechanisms referred to above would have been some of the key tools the EC could have used to keep the project on course had these been available. Indeed the non-existence of the "practical goal oriented workplan" could have become an issue at such meetings that would have been key components of the project control feedback loop.

10 Project Objectives Achievement

It is our assessment that the project has achieved its broad developmental objective of supplying basic electrical services to rural populations lacking access to grid extension. Using a process that is environmentally friendly and affordable. The substitution of kerosene, candles and fossil fuel based grid electricity with photovoltaic electricity has been demonstrated as a technically viable option to grid extension. The sustainability of the technology, however, hinges on financial and

economic considerations. While variances exist between data sources about the actual number of installed systems, it is submitted, that perhaps the target figure of 9 000, 45Wp equipment systems be viewed as a statistic of no significance when looked at in isolation. More importantly perhaps, is the position that the MU has installed as at end of September 1997, several thousand 45Wp equivalent systems through which experience has been gained in the way PV technology may be distributed. It is our assessment therefore, that despite the fact that at the time of this report the target of 9 000 systems had not been reached, the activities undertaken constitute a critical mass through which the objectives of the project could largely met.

At the centre of all the activities is a revolving loan fund mechanism that was meant to operate into perpetuity. It is obvious now that the prevailing interest rate of 15% is sub-economic and as such the fund will certainly deplete to zero if no corrective action is taken. The aspect needs to be addressed.

Through PMU efforts and others, an MSc degree course in Renewable Energy Systems has been on offer by the University of Zimbabwe's Faculty of Engineering since 1996. Together with efforts at Masvingo Technical College, Kwekwe Technical College and the Harare Polytechnic, renewable energy training will be pursued in Zimbabwe. It is however important to note that, no graduates have come out of these programs yet.

New solar installation and manufacturing companies have emerged under the GEF Solar Project. Out of an original five or so companies at beginning of the project, 60 organisations have now registered with the Solar Energy Industries Association of Zimbabwe (SEIAZ). Unfortunately only 30 of these re paid-up members of whom about six of them account for more than 80% of the market share under the GEF Program. This situation is cause for concern, as it indicates that the new entrant companies are still very weak and therefore may require some nurturing. However, it is a satisfactory situation that an identifiable association with a constitution can now represent the solar industry players to government and local authorities. While the association is largely perceived as being weak, efforts to strengthen the organisation through publication of a Zimbabwe Solar Magazine and a SEIAZ Newsletter are in place. It is our understanding that excellent relations now exist between the PMU and SEIAZ. The co-operation is a good platform from which the future of the industry can be charted to the benefit of solar electrification of Zimbabwe.

The Agricultural Finance Corporation has successfully managed the CSF and the financial management experience gained should continue to be utilised in the dissemination of PV technology or for that matter, other renewable technologies.

While three NGOs namely; BUN, ORAP and Southern Centre have been tasked by the PMU to install systems, there has not been sufficient implementation history to evaluate the viability and efficiency of this delivery mode in the long term. The Zimbabwe Electricity Supply Authority has now embraced PV technology and given its institutional capacity could prove to be a key player alongside AFC, in the delivery of solar electricity.

It is unfortunate that the local manufacturing capacity has not been upgraded significantly through the project. Capacity building has been heavily constrained by the lack of capital finance for plant and machinery and the lack of a sustained technology transfer effort by a PV expert. It is pleasing however that some success have been achieved in the local manufacture of DC lamps and charge controllers.

Solar technology has been successfully de-mystified in rural Zimbabwe, but it is still perceived as a little "elitist" in the rural areas. More promotional works still needs to be done but the "seed" has been sown. The real challenge lies in the ability of solar companies to maintain existing systems or else the good but limited awareness so far created may not last. As discussed earlier, commercial, utility, NGO modes have been established, but the community-based facility has failed to take off. More work needs to go into the formulation of a suitable strategy for realising such a credit facility.

11 Systems Quality

Because of the shortage of time, only one cluster of 5 installations was visited in the Chishawasha area. All were 22W non-GEF DIY systems using no conduit, charge controllers nor battery boxes. However from PMU feedback, good workmanship prevailed on most PMU Inspect projects. In a few cases however, more robust mountings of panels could have been installed resulting in fewer cases of module thefts.

It is of interest to note that the average price of a Zimbabwean PV, solar home system (SHS) is about US\$1 000 while experiences elsewhere indicate prices of around USD600. It was the PMU's and SEIAZ's explanation that Zimbabwean installations are more expensive as they are based on crystalline modules, include a charge controller, electrical wiring is done in conduits, and each battery is installed in a special safety wooden box. While such quality aspects contribute positively to the long-term reliability of PV systems, there is a school of thought that argues that the attendant costs for quality may become a price constraint to the dissemination of PV technology to the "poorest of the poor". Our assessment is that, as long as efficient charge controllers and batteries are utilised, the extra cost associated with such devised could be well worth it, given the bad name of the PV installations have has in the early years of the technology. However, all efforts to make PV systems more affordable through device improvements should remain encouraged.

12 "Solar" Uses

PV technology is being used in Zimbabwe predominantly for lighting. It is also used to power radio and television sets, water pumping and to a very limited extent; refrigeration. Solar lighting has had the widest application in homes, schools, clinics and community halls.

13 Significance of the Project.

The GEF Project has had some positive social benefits of literacy improvement through night study for rural children and adults. On the health front, night births at

solar electrified clinics are now possible and safer. It is also evident that electrified schools have better-motivated staff and the same goes for nurses in clinics.

A solar dissemination credit facility has been established at AFC and a promising scheme is coming up at ZESA. If these modes can be structured for long term financial stability these two organisations could be the most important vehicles for solar electrification.

The GEF project has had some policy impact, as Zimbabwe is fast adopting renewable energy technology into the national education curriculum. This trend will have some regional replication in South Africa, Botswana and other countries.

Through the systems installed, the national impact of PV electricity on national grid maximum demand is negligible given the grid peak demand of about 1800MW. However, should the adoption rate of PV accelerate, then perhaps more meaningful discussion could centre on the substitutional effect of PV on the 55% fossil fuel based national grid and the attendant green-house-gas emissions. On a micro-scale however, kerosene and candle use should reduce with PV lighting. However, given the number of systems so far installed, it is not known if any significant replacement of kerosene and candle use has been made at a national scale, let alone regional scale. Solar technology has been de-mystified in Zimbabwe through still "elitist" in a rural sense. The regional impact of the GEF project has been accepted through the FINESSE Program, and any lessons learnt will be shared by participating countries like South Africa and Lesotho.

Part D: Lessons Learnt

14 Lessons Learnt

1. Most renewable energy technologies are relatively new, and the mechanics of the technology dissemination procedures are unlikely to be well known and time-tested. To ensure that project execution stays under control, it is necessary to strategize explicitly, including the elements of activity scheduling, resource allocation, milestone definition and the design and installation of project control procedures. The latter includes project management meetings that must be held with regularity and appropriate frequency.
2. In order to prevent unnecessary dislocations during project execution, sufficient time must be made available for detailed consultations with the potential stakeholder organisations. This will prevent the articulation of impossible proposals in the prodoc, such as the suggestion that UNDP fund profit making entities, ZESA sell systems to customers, rural district councils engage in borrowing activities, etc.
3. For each project, it should not be assumed that the external project execution mode should always be used. The delays associated with running an operation across national boundaries can be avoided if resources and structures are available for the national project execution mode. A preliminary investigation should always be carried out to establish whether these resources and structures are available or not.
4. While renewable energy technologies need to be nurtured through soft financing schemes, the eventual and gradual escalation of financing terms towards market-determined levels must be programmed into the project timeline to ensure sustainability.
5. Exchange risk (from the point of view of a country like Zimbabwe with a depreciating currency) should be managed by demanding local currency payment for imported hardware at the current rate, rather than the rate at the time of placement of order.
6. During introduction of nascent technologies such as renewable energy technologies, a key task is the technology transfer task that must be addressed explicitly.
7. Low capacity among solar companies results in poor after-sales service to end-users. This situation is a major threat to the market position of PV technologies as lack of attendance to failures gives the technology a bad press.
8. As part of the capacity building exercise, the solar energy industry must be provided with access to working capital and plant and machinery capital
9. The community-based delivery mode, while conceptually desirable, is the most difficult to implement as no commercial structures exist on which credit facilities can ride.

10. Solar technology, as it is currently marketed, is not ready for use by the "poorest of the poor" for whom it is still out of reach. The most popular solar systems for households include 3-5 lights and points for radio and TV power. Innovative marketing and R & D are required to address the needs of the poor with affordable hardware.

Part E: Recommendations

15 Recommendations

1. Project Termination

In the opinion of the Consultants, the commercial delivery mode has taken off very well and probably all the lessons that could be learnt from this mode have already been learnt. The ZESA mode took off late, but the demand on this mode has outstripped the 500-system supply several fold in a very short time period. The feeling at the highest level of executive management at ZESA is that the experience to be gained during the installation of the 500 systems will be enough for the utility to learn what it needs to learn before proceeding to the substantive project level. For the utility delivery mode therefore, it is not necessary to extend the pilot phase.

Like the utility mode, the NGO also came on board very late. The lessons to be learnt from this mode are not yet apparent, as not much progress has been registered so far with system installations. In the light of recommendations to follow, it is felt however that the NGO experience will not significantly alter the course the project should take in the post-pilot era.

It is therefore recommended that the pilot phase of the project be terminated at the end of 1997. A maximum period of 6 months beyond project end date is to be allowed for project wind down activities.

2. Last minute customers

It may be expected that as word of the project wind down spreads, there will be a spurt of last minute applications for end-user loans. The PMU is to ensure that hardware orders placed before the end of the year will be sufficient to service the needs of these last minute shoppers in early 1998.

3. Project Winding Down

With the termination of the project, the PMU are to stop procurement of any more hardware. PMU henceforth to concentrate on winding down project business. As applications for end-user credit might still be coming in by the end of December 1997, winding down activities will include:

- ◆ Drawing down of PV hardware from the warehouse to service loans granted but not yet disbursed by December 31, 1997.
- ◆ Inspection of installations completed after that date.
- ◆ Data capture
- ◆ Management of project assets and preparations for hand-over to DoE.

4. The PMU

After the project has wound down, all DoE funded PMU staff to revert to DoE. UNDP funded to be given the option to revert to DoE. ZESA to consider absorbing those PMU staff who can assist it in running its expanded PV systems installation programme.

5. Residual PV hardware

At the end of the project wind down period, any residual hardware in the warehouse to be allocated to ZESA to enable the latter to maintain systems delivery momentum.

6. Residual CSF Funds

Because of UNDP regulations that do not allow direct lending to profit making enterprises, Activity 2 of Output 2, relating to dealer financing, could not be operationalised. Also, the project had not been designed to address the issue of long-term capital for the industry. This is a serious limitation to industry's manufacturing and installation capacity.

It is recommended that, at project termination, residual funds in the CSF be handed over to GoZ and be made accessible to SEIAZ members for purposes of working capital and long term financing. As the ZESA mode is expected to meet most of industry's working capital needs (see below), the CSF will probably end up concentrating on the provision of long term capital.

7. The needs of the low income sector.

At this stage, the project has not effectively addressed the issue of the rural poor in general and rural women in particular. The task of conducting *"an effective outreach program to these beneficiaries in order to identify their desired services, specifications and prices for the required PV products as well as provide the information on the basis of which the method of payment will be established"* needs to be revisited.

It is recommended that in the short to medium term, DoE and ZESA should plan for the mobilisation of urban cash to service rural needs. Promotional campaigns should target the urban worker and motivate him/her to procure the necessary hardware, eg magic lanterns and DIY kits, on behalf of rural dependants who are not able to generate steady cash flows. Because of the stability of the wage/salary earner, be he/she urban or rural, it is possible that highly mobile systems such as lanterns and DIY kits could be sold to them not just for outright cash but also on terms and on perpetual lease. In particular stop orders can be arranged with the Salary Service Bureau in the case of civil service customers.

It is also recommended that the Scientific and Industrial Research and Development Council (SIRDC) addresses the issue of R & D into systems that could meet the requirements of the rural poor. The R & D effort would be prefaced by a marketing study designed to define the needs of this sector and the specifications of the

required PV products. The study should also generate the information on the basis of which the method of payment will be established.

In the long term it the needs of the poor cannot be addressed in isolation from the general developmental context. It is recommended that DoE/PMU undertake the intra-governmental liaison necessary to incorporate aspects of renewable energy in general and PV technology in particular in rural development strategies.

8. Local PV hardware manufacturing capacity

Output N^o7, "Improved technological capacity, within local industry, for the manufacture of charge controllers, batteries, lights, small systems, battery charging systems and assembly of solar PV modules" was to be supported by:

Activity 7.1- Prepare and put in operation a medium term capacity building workplan for strengthening local know-how on PV technology

Activity 7.5 – Design and support a research and development programme for the local manufacture of small PV systems and

Activity 7.6 – Develop a technology transfer and technical assistance plan to the local industry to be implemented with the PMU's own experts, short term consultants and other technical specialists as required

It appears that none of the plans/programmes referred to above are as yet in place. This is a critical area in the context of sustainability of the local effort to deliver PV technology. It is recommended that this issue be revisited, probably in the context of the World Solar Programme (WSP). A relevant project suggested in the document "Zimbabwe High Priority Projects for the World Solar Programme:1996-2005" is entitled " Capacity Building for Solar Equipment Production"

It is recommended that the SIRDC take over the small systems R & D task

9. Publicity Campaign

During the wind down period, PMU to carry out an exercise, with the assistance of consultants if necessary, to gauge the success (or otherwise) of the publicity campaign countrywide.

10. The ZESA Mode

For reasons already stated, it is expected that the ZESA mode may be the most effective and efficient one for the wide dissemination of PV technology in Zimbabwe, in particular to perpetual lease and cash purchase buyers. Currently ZESA are using their own teams to commence the installation of the 500 systems allocated to them under the project. This is to enable ZESA to gain experience with this kind of construction projects. Sometime during this learning period, all outstanding installation projects will be contracted out to SEIAZ members. The following are recommended:

- 1 ZESA to contract out all installation work
- 2 ZESA procedures for contracting out installation work to take into account the need to nurture emerging PV installation companies, possibly through the existing quota system for indigenous businesses. ZESA would also be in a position to influence the decentralisation of the country's PV installation capacity through "zoning" eligibility criteria for its tenders.
- 3 In the case where a customer contacts ZESA with a specification of his PV system requirements, the system could be delivered using the following steps:
 - 3.1 ZESA, if necessary, visit site to assess layout of structures to be electrified.
 - 3.2 ZESA carries out system design, and costs the hardware requirements.
 - 3.3 ZESA estimate installation costs for purposes of calculating preliminary deposit.
 - 3.4 Customer pays estimated deposit and is made aware of monthly payment estimates, with the proviso that these figures may change when tender prices eventually come.
 - 3.5 Project is incorporated into a program of projects from a defined geographical area.
 - 3.6 ZESA go out to tender for program's installation services.
 - 3.7 Tender is adjudicated and awarded.
 - 3.8 ZESA calculate firm deposit and monthly payments figures based on tender prices and their "consultancy" charge.
 - 3.9 Customer pays any shortfall on deposit or is refunded any excess payment
 - 3.10 Installation commences.
 - 3.11 When installation is complete, ZESA inspect the installation.
 - 3.12 Completion of Work (CoW) certificate is issued, or remedial work ordered as necessary.
 - 3.13 Installation contractor is paid after CoW is issued.
 - 3.14 End-user starts paying lease charges, or pays balance of cash purchase.
 - 3.15 After sales service by ZESA as required, charge-free for perpetual lease and during warranty period for outright purchase, and for a fee after warranty period for outright purchase.
- 4 An alternative approach would be as above, except that the customer may not be willing wait for ZESA to accumulate a program of projects before going out to tender. In that case the customer may pick say, three installers from ZESA's Approved List of Suppliers and get from each a design, and an installation quotation. ZESA carry out a technical vetting of the designs and the customer chooses the design to be implemented from the designs approved by ZESA. On the basis of the price of the customer's choice and ZESA's "consultancy" charges, the deposit and monthly payment figures are calculated. The customer's chosen installer may or may not supply his own hardware. This addresses the situation where hardware, for some reason or other, may not be immediately available at ZESA. As a cash buyer would probably go directly to a SIEAZ member if it were felt that ZESA couldn't deliver on time, this alternative would probably address the needs of perpetual lease customers only.

- 5 In order to assist in the enforcement of standards, and create conditions conducive to the growth of SEIAZ, ZESA is to insist that only members of SIEAZ may tender for ZESA's PV installation projects.
- 6 ZESA to pursue their intended objective of closely analysing the performance of all installer companies in the field. Any good reputation so gained in the field may be used, as objective evidence of good business sense, to back up applications for working and long term capital from sympathetic indigenous banks.
- 7 ZESA to pursue their intended objective of training rurally based service personnel who shall attend to minor system faults. These repairmen will be paid by ZESA for all work on systems under warranty and those on perpetual lease. For work on user-owned systems beyond the warranty period the repairs would be paid for by the end-user. The repairman will refer all major system faults to the nearest ZESA depot for attention. As for the repairmen, ZESA will charge the end-user for repairs beyond the warranty period, but not for systems under warranty or on long lease.
- 8 ZESA to carry out a vigorous campaign to create awareness of the advantages of their mode of delivery of PV technology. It is expected that because of ZESA's high level of credibility with the public and the attractiveness of the perpetuity rental/leasing payment system, most of future demand for installations will be met via this mode, perhaps allowing other modes to die a natural death.
- 9 ZESA to consider absorbing, in the post-GEF period, key PMU staff and systems, including the MIS, hardware purchasing function and the testing facilities.
- 10 ZESA to use keep PV hardware prices under control by bulk purchasing (by the container) and issuing hardware to installation tender winners as a way of addressing industry's lack of working capital.
- 11 Some of the residual PMU hardware to be to be loaned to ZESA, on current terms, in order to maintain the momentum of this delivery mode.
- 12 In addition to GEF funding, ZESA to use the RE Levy, the proposed Producer's Levy and soft finance – low rate of interest, long repayment period after a grace period - to finance PV technology dissemination.
- 13 PMU/ZESA to investigate into other sources of concessional finance (eg UNDP, IBRD, E & Co) that could be made available to ZESA for co-funding of PV installation activities.

11. The Commercial Mode

1. Because of the need to have a system in place to accept instalment payments at least 3 years after the end of the project, it is recommended that the AFC Credit Support Facility remains in place for now to look after these future cash inflows and manage loans granted but not yet disbursed.

2. It is expected that if the ZESA mode takes off in a big way and probably fully service the needs of the perpetual lease and cash purchase customers. ZESA are however not keen on servicing the needs of the customer who wishes to purchase a system on terms. The CSF can continue to service the needs of this customer but the AFC would need to make arrangements for the acquisition of services currently provided *gratis* by PMU. Arrangements can be made, as a business decision, to either install in-house expertise or contract this task out to external agencies – eg ZESA, consultants etc – for a fee.
3. To stem the extent of fund erosion with time, it is recommended that the CSF lending rate be escalated over a period of time to more realistic levels of perhaps 0-2% real.
4. If in the post GEF era the residual funds are taken over by GoZ, the CSF to be opened up to SEIAZ members for the purpose of providing working and long term capital to SEIAZ members. If the ZESA mode takes off in a big way, it is expected to satisfy most of SEIAZ members' working capital needs, so the CSF would then concentrate, in the main, on industry's long term capital requirements.
5. Consideration to be given to the extension of the repayment period from 3 to 5 years, as the lending rate is escalated, in order to keep monthly payments low.
6. In the post GEF era, SEIAZ members to use own resources to purchase and warehouse PV hardware for incorporation into non-ZESA systems.
7. SEIAZ to act as the ethical watchdog over its members in order to enforce installation standards.
8. SEIAZ to levy members joining and subscription fees as a way of raising funds with which to finance a secretariat – an approach similar to that used by the Zimbabwe Institution of Engineers (ZIE), the Construction Industry Federation of Zimbabwe (CIFOZ) and the Zimbabwe Building Contractors Association (ZBCA) etc.

12. The NGO mode

The NGO mode is seen as the one most likely to meet the needs of the low-income sector. It is also an important marketing tool as it increases the visibility of the technology in the more remote rural areas. However, because of its softer lending terms, its mini-CSFs are not sustainable and need to be periodically seeded in order to stem capital erosion. The lending rates cannot be escalated, as this would move the technology out of the reach of the poor.

It is recommended therefore that as the NGOs' allocation gets depleted as installation progresses, PMU/DoE carry out a terminal evaluation of these delivery modes and assess what lessons will have been learnt.

Part F: Appendices