Appendix Document 2

Appendix Document 2.3-1
Schemes and Features of PV Projects in the World

Scheme and features of PV projects in the various developing countries are enumerated in Appendix Table 2.3-1.

(1) WB/IFC/GEF-PVTMI Project

The Photovoltaic Market Transformation Initiative (PVMTI) sponsored by World Bank (WB)/ International Finance Corporation (IFC)/ Global Environment Facility (GEF) is a strategic intervention to accelerate the sustainable commercialization and financial viability of PV technology in the developing world. It is based on the premise that private sector project design and financing on a commercial basis will stimulate more sustainable ventures than government or donor financed PV procurements. This direct engagement of the private sector and placement of targeted financing from a limited pool of funds is expected to maximize co-financing and result in support for the most sustainable and replicable projects.

PVMTI will make selected concessional investments in private sector PV market development projects in India, Kenya, and Morocco. With technical assistance and appropriately structured financing, these projects are eventually expected to provide successful examples of sustainable and replicable business models that can be financed on a commercial basis.

A central objective of the GEF Operational Strategy is to promote sustainable growth in development and financing of renewable energy as direct alternatives to fossil fuel combustion -- the main source of CO2 emissions that are said to be a cause for global warming.

As mentioned below, host countries of PVMTI have relatively large population and higher population density and are advanced in PV applications. Therefore, PV development on a commercial basis is more feasible than other countries including Botswana.

With about 11 MW in annual sales, India is the largest PV market in the developing world and represented about 12% of world PV sales in 1996. It is

uniquely positioned in the developing world in that it has a complex PV industry with multiple suppliers and many market segments. Government equipment procurements, 100% first year depreciation for corporate-owned renewable energy projects, and low cost financing (in part financed by an earlier World Bank/GEF project) available through the Indian Renewable Energy Development Agency (IREDA) have resulted in rapid growth, with the current installed PV capacity reaching 27 MW. In response to these incentives, and given strong import tariffs on modules, over a dozen cell and module manufacturers have emerged, with almost the entire market served by indigenous manufacturing companies.

However, the annual market of approximately 11 MW uses less than half the available module manufacturing capacity. A large portion of the PV manufacturing industry is specialized in assembly operations. Module quality and efficiency are mixed, and relatively few companies can be price-competitive in world markets. Many systems are poorly installed and do not perform well. The overall Indian market suffers from high customer dissatisfaction and limited market penetration outside of government purchases. Despite these shortcomings, India remains an attractive market. While 85% of villages are nominally on the grid, household connections are very limited, and power quality and availability are low. There is a burgeoning middle class that wants and can afford small power systems. India also has a well-developed financial sector with experience in consumer finance and leasing. It is expected that PVMTI will encourage some of these organizations to offer PV financing services either on a stand-alone basis or in conjunction with PV companies.

Kenya is viewed as a truly open market for PV products. Three quarters of the population (some 20 million people) live in rural areas, and there are now over 50,000 solar home systems installed. The SHS installation rate exceeds the rate of rural grid connections provided by the government-operated Kenya Power and Light Co. The current market is approximately 0.3 MWp per annum, the majority of which is for small systems often utilizing 12 Wp amorphous silicon modules. Although there is no indigenous cell or module manufacturing capacity, there is some local BoS manufacturing and assembly of widely varying quality. Despite some inconsistencies in import tariffs, the government is broadly supportive of PV technology imports. While Kenya offers a promising private-sector driven market, many Kenyan PV companies are quite small and have inadequate management and technical skills. The majority of

sales have been for cash, and financial institutions operating in rural areas have only recently begun to experiment with offering services to the PV sector. While quality problems are acute and could result in long term consumer dissatisfaction, current satisfaction levels with SHS are over 60% and consumers show considerable understanding of the limits and benefits of PV systems. Even though the level of PVMTI financing in individual sub-projects is initially expected to be small, these sub-projects will be instrumental in increasing annual sales by more than 60% over the 0.6 MW base case projections for 2003. It is also strongly recommended that additional training, business advisory, and consumer awareness initiatives be undertaken in Kenya to facilitate sustainable market growth and improve the likely performance of the project portfolio. These services are likely to be subsidized using PVMTI funds (either as direct grants to investee companies or as additional required financing at more favorable terms) and will be provided locally through the EMT or its consultants.

The Moroccan PV market to date has been largely government driven. As of 1997, approximately half of the population has been electrified with a grid that is largely reliable. Building on a sequence of rural electrification programs, the government is committed to electrifying much of the country (an additional 1.6 million households) by 2010, and has indicated that approximately 5 percent of those buildings will likely be electrified using off-grid solar and wind technologies. The state owned electricity provider, the Office Nationale du Energie (ONE), is now willing to contract for private PV-based electricity for these services and has recently undertaken its first such contract on an experimental basis. Sources indicate an installed PV base of 2 MWp with annual installations of around 500 kW. Import of panels by immigrant Moroccans returning from Europe is believed to have contributed a further 1 MW to the installed base and currently accounts for an additional 500 kW per annum.

There is a strong rationale for PVMTI financing in Morocco to be integrated closely with the national commitment to rapid rural electrification, and private sector participation is seen as greatly increasing the chances for success in sectors served by PV. It is expected to be instrumental in increasing annual sales by more than 30% over the 1.5 MW base case projections for 2003.

(2) WB/US-DOE Indonesian Banpres Project (1993) and WB/GEF-Indonesia SHS Project (1997 to 2002)

The Indonesian government is strongly committed to its heavily subsidized conventional rural electrification program (cost recovery at present tariff levels is estimated to be about 50%), and it has been electrifying ca. 2000villages annuallyover past decade. Providing PVs is seen as a way of bringing the benefits of electricity to villages with no prospect of receiving a conventional supply within the next 10 years. The Banpres Project is envisaged as a prototype for a much lager PV program in the future.

The SHSs provided under the program consist of a 45Wp to 50Wp panel, charge controller, battery, and two lamps. Users pay an initial fee of about $25 and a monthly fee of about $3 for 10 years. This represents the payment of a $500 loan at no interest. The fee is comparable with that paid by utility consumers. Users are expected to purchase replacement batteries when they are required. The system is designed to provide 7 to 8 hours operation daily for both lamps; by reducing the amount of lighting, a black-and-white TV can be used. About 3000 SHSs were installed in 1991-1992.

The lead organization in the project, BPPTeknologi, is drawn from a range of government ministries with rural development and energy responsibilities. It oversees the technical aspects of the program and manages the revolving fund created by the fees paid by SHS users. Actual field implementation is carried out through the cooperative system. The local cooperatives, KUDs, are responsible for fee collection, record keeping, and basic technical support and they receive a small portion of the monthly payments to cary out these activities. Private firms are responsible for supplying systems and components and providing after-sales service and training to KUDs.

The results of the project so far have been promising, but some indications of possible future problems are apparent; these relate to fee payments, especially when batteries begin to require replacement; levels of maintenance; and the reactions of consumers when they cannot expand systems to meet their growing electricity demands.

The WB/GEF-Indonesia SHS Project (1997 to 2002) is to support installation of ca. 200,000 SHS in 4 regions markets in rural Indonesia. This project is working to commercialize SHS in Indonesiaan rural areas and catalyze market acceptance of SHS as part of a least-cost rural electrification strategy that relies on private sector delivery and installation. The intent is to create a sufficiently large market for SHS to accelerate wide-scale purchase of SHSand broaden product offerings. The project is supporting installations of about 200,000 such systems in up to four regional markets, focusing on areas too remote to connect to existing grids but reasonably close to urban centers. The project will also develop a strategy and action plan to meet the energy needs of rural populations for whom SHSs are the least costly alternative. Project activities will strengthen the capacity of the Indonesian Agency for the Assessment and Application of Technology (BPPT) to promote SHSs.

Activities:World Bank loan and GEF grant to enable rural purchase of low-cost SHSs on an installment plan. Technical assistance on implementing the project, developing policies in the form of a strategy and action plan, and strengthening BPPT's testing and certification capabilities for SHSs.

(3) Concessions for Rural Electricity:

1) Argentina's Approach

Argentina has pioneered the use of concessions for the provision of electricity in rural areas as a way to both provide energy services to rural areas and stimulate domestic PV sales. As part of the electric utility privatization process in Argentina, provincial governments are bidding out concessions for the provision of electricity in rural areas where there is no grid power.

So far, two provinces-Salta Province and Jujuy Province-have sold rural concessions to bidders who also purchased the on-grid power concession. The private utilities are now starting to provide electricity, mainly with solar PV home systems, to the unserved populations. They charge the households for the electricity in the same manner as they would charge on-grid customers-that is, the households do not enter into loan or lease agreements, but pay a monthly fee to the utility for the electricity for as long as they have the systems. The utilities own the PV systems and are responsible for all maintenance.

In order to accelerate the establishment of the program and give the utility some operating experience, the government of Salta Province is guaranteeing that it will purchase 450 PV systems from the utility for various public

facilities. The government in Jujuy Province has established a fund to subsidize modestly each PV installation, thereby keeping monthly consumer fees down while allowing an adequate return for the utility. It is not clear whether this subsidy approach will be sustainable.

So far, there is insufficient operating experience to gauge how well the rural concession approach is working. Nonetheless, other countries, most notably Brazil, are already preparing to implement some variation on it. One of the potential problems is that even though the program is being run by private institutions, the provincial governments have a strong regulatory role. It may be reasonable for a provincial government that regulates on-grid retail tariffs to also set the off-grid tariffs and specify minimum quality and service standards. However, a problem arises that if the tariff is set too low, the utility will earn an insufficient return and will not adequately promote, market, or service the PV systems. This problem is already materializing in Argentina's Salta Province.

2) South Africa's Approach

South Africa is proceeding concession approach giving concession, in a limited area and scale, of PV rural electrification to private or parastatal utilities. ESKOM/Shell, ESKOM/BP, etc. are proceeding PV electrification for 60,000 households. As for an example, South African private company, RAPS, established a joint-venture company with a Dutch company, Nuon. RAPS-Nuon got concession of PV electrification for 50,000 households in Northern Province within 4 years.

The scheme of the business plan is as follows:
Execution body; Nuon-RAPS Utility
Taret households; 50,000
PV scale; 50 Wp/household
Fee; Downpayment: SA Rand100 to 150, Monthly payment: R50
Management; 42 "Energy Stores" will be nominated for 50,000 households (1400 households/1 Energy Store). Fee collection and maintenance of the system will be done, basing on the Energy Store. Users purchase pre-paid cards and utilaze electricity as much as pre-paid.
Total system cost/household; ca. R3200 (Subsidy; R2800)

Therefore, initial investment can be covered by government subsidy and users' downpayment and fees for "Energy Stores" and maintenance fees can be covered by users' monthly payments. It is said that the IRR of the project will be about 20%.

3) Mexican Approach

In Mexico one of the first subsidized large programs was launched in the late 1980s by the government and national electricity utility (CFE) as a "least cost" rural electrification plan – the so-called Pronasol program. Wherever the PV option for basic service could be introduced more economically than grid extension and with the acceptance of the rural communities, the CFE would issue tenders for PV suppliers to install and maintain the SHSs, for which the users would pay a fixed monthly service fee. Between 1991 to 1994, more than 5MW of PV systems were installed in over 10,000 rural homes and by the end of 1998 more than 40,000 SHS had been installed.

(4) Dominican Republic: Leasing and Fee-for-Service Approaches for PV Systems

In developing countries where consumer awareness of PV is strong-such that there is high pent-up demand for financed units-leasing and fee-for-service approaches have worked, but with only a very few examples of success. In the Dominican Republic, SOLUZ-Dominicana has established a 1,000 or more unit leasing program, and is now cash-flow positive.

SOLUZ-Dominicana was able to secure enough capital to test the leasing program on a smaller scale (200 units), make corrections, and then continue to finance the rollout to reach a cashflow breakeven level. Lock-boxes located in prominent buildings which customers are likely to visit anyway are used to make collections. Local, independent collection agents are rewarded when collection levels are high, and these collection agents let SOLUZ know about SHS lessee family credit problems before they become serious. In addition, SOLUZ has a credible repossession program, where lessees who do not pay their installments lose their units quickly and visibly, sending out the signal to other lessees that nonpayment is not acceptable. Finally, SOLUZ is able to provide excellent maintenance and after-sales service on its PV units. It has the incentive to do this, because it owns the systems. Just as important, if the systems do not operate for any reason-even poor customer education or overuse-SOLUZ cannot collect lease payments; this gives SOLUZ an incentive

to educate its lessees well at the front end, and then to call on them periodically to make sure that the system's operation is not being hurt by poor customer operating practices, a phenomenon which has been a real problem for the SHS industry in a number of countries.

The leasing program established by SOLUZ-Dominicana is a good model for programs now being undertaken by SOLUZ affiliates in other countries, and the financing credibility at the distributor level is now growing, such that the distributor can attract increasing amounts of capital at market-based pricing. However, despite its success, the SOLUZ model in the Dominican Republic is not one that would be easy to replicate. The SOLUZ CEO, Richard Hansen, was particularly effective in persuading some initial soft-money investors and foundations that they should support his trial efforts to prove the model. Now that this has been done, private capital will support the continuation of SOLUZ's growth. Entrepreneurs in other countries who lack Hansen's connections in the North American foundation community would face a tough challenge in attracting the necessary start-up capital.

Appendix Document 2.3-2 Visiting Memorandum

Date: February 9, 2000
Reported by: Mr.Shizuma
Accompanied by: Dr. J. A. Opperman, Mrs. M. V. Collar,
Solarvision: Mr. David Motaung

Field Survey of Concession Type PV Electrification in Mbahe Village in Northern Province, South Africa

In May 1999, Solarvision was granted of twenty-year government concession for SHS and PV-mini-grid based, non-grid electrification projects in commercial service zones of District Council (DC) 34 and 35, and CBDC3 in Northern Province. The concession agreement also includes supply of LP gas, lighting paraffin and related equipment to all villages in the project area through activities of rural energy stores. The company will become the first non-grid utility company to enter the concession agreement covering PV electrification and will sign the formal contract with National Energy Regulator, Department of Minerals and Energy Affairs, ESKOM, by the end of February 2002. Northern Province has land area of approximately 123,900 square meters and population of 5.7 million. Of total population, 35 million people are not served by the grid utility company and the provincial government plans to implement a PV electrification project. In conjunction with the concession scheme Solarvision spent already, a total of R3.9 million as infrastructure and operation costs between May 1999 and December 2001. In September 2001, a pilot project started to install and operate 150 SHSs in Mbahe Village located in the project area. I visited the village to check the current status of the pilot project by interviewing village members.

1. General Outline of the Concession Scheme
   - Contractor: Solarvision (South African private company specialized in PV system installation and operation)
   - Project period: 20 years starting in 2002
   - Total project budget: First phase (5 years) covering 60,000 households (12,000 per year); R57.6 million/year (total: R288 million)
   - Government subsidy: Capital subsidy - R3,500/system (initial investment (covering the entire costs for the PV system, lights and internal wiring, as well as lamps and batteries)

2. General Profiles of Mbahe Village

Northern Province has a relatively high percentage of low income population, it is said that 3.5 million people are not electrified. Mbahe Village is 90 km from Louis Trichardt, located 380km north of Pretoria. (from Louis Trichardt, 70km on Highway R523 and further 20km on a dirt road) The village is located in an adjacent area where bananas and mangos are widely cultivated. Infrastructure development has not much progressed in the area after the end of the apartheid and most roads are narrow and are not well-maintained. Residents in Mbahe are mainly engaged in agriculture for self-consumption and rarely own cattle, making a sharp contrast to farms in Botswana that are specialized in cattle raising. However, they seem to be relatively rich with the ability to pay for SHS service. In the village, 150 systems were installed to account for 68% of 220 households in total.

3. Current State of PV Electrification and System Operation

1) Project organization at Solarvision

The company has a project office in Louis Trichardt, which consists of a regional director, two relations officers, and technicians. Installation of SHS is carried out by local village people. At present, 20 people hired by the Louis Trichardt office as junior staffs responsible for SHS-related construction work and maintenance. Then, service personnel who is engaged in system maintenance and collection of user charges from village solar shops will be hired in the future. The company expects that total employment will reach 385 in the next three to five years. I interviewed David, a relations officer. According to him, the Louis Trichardt office has only five staffs and he services Mbahe and other villages.

The current rate of PV system installation is 500 households per month. It is planned to be accelerated to 1,000 households per month after July. David visits each village once per week. Once installation and maintenance services proceed smoothly, according to him, less frequent visit will be required.

2) Village organization for the project

A project steering committee was organized by a representative of the municipality (equivalent to the district council), a district councilor, and the chief of the village to make important decisions related to the project.

a) Collection of money and field maintenance personnel

The owner of a grocery store at the village entrance (generally called a "rural energy store") serves as customer service personnel related to PV. He has received a

one-week training at Solarvision and handles user claims and its first line maintenance, customer management such as money collection, client variation requests and other services. The store also keeps spare parts, including fluorescent lamps, which are supplied for replacement with free of charge.

b) PV systems at public facilities

A 1,000Wp/220VAC PV system is installed at an elementary school and 2-4 lights are used in each room. The system is managed by the electricity department of the municipality.

3) System outline, rate system and commission to the agent

a) System description

Only 50Wp DC systems are used for every clients. The prepaid card system is not used.

b) Rate system

- Deposit: R100 in advance payment are required for the 50Wp system.
- Service fee: R58/month are collected from each household.
- Service fee is kept by the agent, from which David makes collection every week. According to the Solarvision, the collection rate is over 98%.

c) Commission to the agent

The agent receives a monthly salary of R500 for his service, plus a commission at a rate of R2.50 per household from the monthly service fee of R58 (R55.5 are sent to Solarvision).

d) Penalty for nonpayment

If a user fails to pay the monthly service fee for three consecutive months, the panel, batteries and the control board will be removed, while internal wiring will be left intact to allow resumption of service one the outstanding payment is made. The system may be removed without the approval of the steering committee (which has already approved it as general policy)

4) Anti-theft measures

No anti-theft measures are taken. The PV system in the school does not have fences. Theft has not occurred and will not occur.

5) Willingness

David and the village agent have shown us around and responded to our questions in detail. It was Saturday. They took us a filed tour, visited a company, and worked later.

Compared to Government-owned organization I felt strongly that they seem to be well motivated and work hard.

Appendix Document 2.3-3 EMPOWERMENT

1. BACKGROUND

Rural villages are situated in the rural areas of South Africa, and the other parts of Africa. Usually there is no electricity, no running water, but usually has access to a school and a community centre. There are usually roughly 300 – 1500 homesteads with approximately 1200 to 6000 inhabitants in the village; usually the community have no formal economic activity. Communities historically own much of the surrounding land of which some of it is leased to white and black farmers. The land set aside for agriculture has not been utilised because of a lack of irrigation water.

The headman of the village, usually approaches an NGO to assist in uplifting and improving the plight of the village. The NGO, usually does long-term planning to establish an economically viable rural community through the use of solar energy. The program is usually given a name.

The plan is divided into three phases, of which the first phase is currently heading for completion.

Empowerment projects are subdivided into phases. The phases are usually the following:

PHASE 1

Objective

The objectives of the first phase to:

1. Establish organisational structures within the community to manage the project
2. Implement a pilot solar installation phase to ascertain the effectiveness and sustainability of solar energy in uplifting and empowering the community
3. Provide basic skills training in order for the community to begin working
4. Begin irrigation and farming activities
5. Seeking funding for the second phase of the project

1.1. Organisational Structures

The local structure consists of a Project Management Committee (PMC). The chairman is usually the headman, and a committee comprising five women and two men assists him. The committee oversees five activities within the project, namely:

1. the development of home industries
2. farming activities
3. food processing
4. the maintenance and provision of the solar systems
5. the provision of water for irrigation and drinking.

Each activity is controlled via a sub-committee. The PMC also liases with local government and municipal structures.
The PMC shall also established a trust fund, wherein money generated by the community is deposited and out of which new materials are purchased and people are paid.

1.2. Installation of Solar Systems

The pilot solar installation consisted of the:

1. Provision of lighting for one room at the community centre
2. Provision of electricity for three sewing machines
3. Installation of a digital satellite TV (DSTV) system with power supplied from a solar system
4. Installation of a 200 litre solar hot water system
5. Installation of a solar powered borehole water pumping system for irrigation
6. Installation of a single solar home system consisting of two lights and a radio adapter.
7. Installation of a small solar drier for drying fruit and vegetables grown in the area
8. Donation of sunstoves, parabolic cookers and paraffin cookers for baking

1.3. Provision of basic skills and training

The solar energy inspires the inhabitants of the community to start a sewing project. To help them a six-week sewing course should be organised teaching them the basic skills of sewing. This course teaches the ladies how to make school uniforms, tracksuits and

family clothing. These courses are certified and are usually funded by the Department of Labour.

Two men on the committee get trained in the maintenance of the solar equipment installed during the pilot phase. In the second phase of the project, these men will form the core of a team (from the community) that will be trained to service, maintain and upgrade all the solar related equipment in the community.

1.4. Initiation of farming activities and irrigation

With the help of The Department of Agriculture, one acre of land can be irrigated and a variety of vegetables planted. A number of fruit trees can also been planted. The Department of Agriculture has also supplies plants and the provision of seeds, fertiliser, and implements and with the training in basic farming skills.

1.5. Request for further funding

In conjunction with NGO, business plans shall be sent to numerous organisations to raise funds for the completion of the second phase of the project. Some of these organisations include Old Mutual, National Development Agency, SAB, Zenex Foundation, the Spanish Government, WK Kellogg Foundation, Compaq, Transnet and USAID. Funding from whatever source will first be allocated to the completion of the second phase of the Faranani Project, with subsequent funding to be used for similar work in new village (Examples of companies approached in South Africa).

2. PHASE 2

Objective

The objectives of the second phase are:

1. Determine the effectiveness of the first phase and the pilot solar installation
2. Expansion of the solar infrastructure to include Solar Home systems, water purification system, complete electrification of the school and community centre, additional solar driers and Sunstove cookers, higher capacity borehole pumping system and the establishment of a Solar shop
3. Provision of further skills for the community
4. Identification of commercial and business potentials for the community
5. Submit request for funding for Phase 3 of the project

2.1. Ascertain the effectiveness of the first phase and the pilot solar installation

The structures that have been put in place have proven tremendously successful. The villagers are encouraged to take their own initiatives and to carry their own responsibilities, enabling them to develop unaided in the long run. The NGO's involvement decreases, and village need only be visited once very few months.

The lighting in the community centre can successfully provide illumination for the home industry activities and for social gatherings during days of bad weather or at night. The DSTV system can be used for adult education and entertainment purposes. Patrons are charged a fee of 50 cents to watch soccer matches on weekends. The income from this activity is ploughed back into the trust fund.

Hot water systems can provide up to 200 litres of hot water a day. It is the only point in the village where hot water is available at this stage. The system is a tremendous help to the mothers of the community for facilitating the bathing of toddlers from the crèche. A crèche is should also be provided for.

A solar powered borehole pumping system can successfully been used for irrigation of at least 5.5 hectares of arable land. The community shall be trained in cultivating a large range of crops both for commercial and local consumption.

The single solar home system that is planned to be installed should operate flawlessly for at least eighteen months with a high user satisfaction. The electrolyte level of the battery should not require replenishment during this duration indicating a high quality and standard of the components in the system.

Extra income shall also be generated from the drying of the fruits and vegetables. The solar drier currently must have a capacity to dry up to 20kg of produce in three days, yielding approximately 2.8kg of dried vegetables and 4kg of dried fruit.

The cookers can be used to bake biscuits and bread, as well as for making jams, attar and chutney. All surplus products are sold to the surrounding communities. The paraffin cookers are used for baking indoors when it is overcast or raining. At present only ten loaves of bread are baked each day.

The quality of the garments sewn by the ladies of the community should be of high standard. A separate enterprise is usually started to make and sell school uniforms to surrounding villages and towns.

All money generated by the community in selling garments, vegetables (dried and fresh), fruit (dried and fresh) and bread is put back into the trust and is reinvested in the project. A cost benefit analysis has indicated that a community's present financial return from the farming, manufacturing of clothes and food production can exceeds the cost input by approximately 25 percent making the project viable and the community self sustainable (But an actual study must be made of each village).

2.2. Installation of Solar Home Systems

If 120 solar home systems are installed. This will provide basic illumination to each house as well as power for basic communications e.g. radio. A typical system shall be able to provide:

1. Three lamps for three hours of illumination per day
2. A radio adapter for supplying power to a portable radio
3. A cell phone charging output socket for recharging a cell phone
4. Three days of autonomy in the case of bad weather
5. An extra DC power outlet for connection to a DC television or hi-fi

A solar home system comprises:

1. One 38Watt solar module conforming to IEC61215[1]
2. One 85Ah deep cycle battery
3. Three 9Watt lamps
4. One radio adapter with a 6V, 9V and 12V output conforming to NRS052-1[2]
5. One Battery box conforming to NRS052-1
6. One 10A regulator with advanced energy balance algorithms
7. One Wooden pole with mounting frame for either a 38W or 60W solar module

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[1] IEC 61215:1993, Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval.

[2] NRS052-1: 1999, Photovoltaic systems for use in individual homes – Part 1: Standardised requirements for application in a national programme to provide solar power to individual homes remote from the electricity grid.

8. Three pull switches
9. All necessary cabling
10. One cleaning kit conforming to NRS052-1
11. One operating manual conforming to NRS052-1

2.3. Provision of Sunstove cookers

120 homes shall each be provided with a Sunstove solar cooker. By placing this device in the sun, food can be cooked in three to four hours. These items are maintenance free units that focus the energy from the sun onto a pot placed inside the cooker. With this basic device, each household shall be capable of cooking a meal during days of good or partly cloudy weather.

2.4. Installation of a Water Purification System

A solar powered water purification system shall be installed to provide potable drinking water for the community. Such a system eliminates the dangers posed by contamination from bacteria such as E.coli and cholera. The system would be capable of producing up to 6000 litres of water a day, with a five-day autonomy. The system is designed such that its life cycle costs are minimised as compared to standard chlorinators. The only maintenance required would involve the replacement of an illumination tube every twelve months at an estimated cost of R 1000. The purification system has recently passed laboratory tests conforming to the requirements of SABS SM 221[3], SABS SM 1196[4] and SABS 241[5].

The installation will comprise:

1. One solar powered borehole pumping system for supplying the water from a river or a borehole
2. The sinking of a new 6-inch borehole to a depth of 25 metres
3. Three 10 000 litre tanks for water storage
4. The ozone-based water purification system
5. Installation of one theft-proof solar module mounting frame
6. All the solar equipment required for powering the system

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[3] SABS SM 221:2001, Microbiological analysis of water – General test methods

[4] SABS SM 1196:1992, Examination for the presence of viable pathogenic Vibrio organisms in foods

[5] SABS 241:2001, Drinking water

7. Installation, training, transport and commissioning
8. Installation of the Galaxy 'Solar Sentry' alarm system

The cost of a litre of potable water over a life of fifteen years is calculated at about 0.6 cents/litre.

2.5. Upgrading of the Irrigation System and cultivates

2.5.1. Irrigation System

The existing pumps will be upgraded and an additional solar-powered borehole pumping systems be installed to increase the volume of water required for irrigating the arable land. In addition, one new borehole will have to be sunk to at least a depth of 25 metres. It is estimated that the level of the underground water is situated at approximately 15 metres. From this depth, each pump would be capable of producing up to 9000 litres/day for a total of 18 000 litres per day. With this volume of water, the size of arable land will increase to two hectares from the current area of about one acre.

The installation will comprise:

1. The sinking of a new 6 inch borehole to a depth of 25 metres
2. The installation of one new solar powered borehole pumping system capable of delivering up to 9000 litres of water per day
3. The upgrading of an existing borehole pump will be capable of delivering up to 9000 litres of water per day
4. Installation of two 10 000 litre water storage tanks on six metre high stands
5. Installation of two theft-proof solar module mounting frames
6. Erection of two electrified fences around the water pumping systems to deter tampering and theft
7. All installation, delivery, training and commissioning
8. Installation of the Galaxy 'Solar Sentry' alarm system.

2.5.2. Acquisition of cultivates

New seedlings and seeds shall be purchased to increase the variety of the produce farmed on the farm. This will include fruit trees such as mangoes, peaches, kiwi fruit, figs and apricots as well as vegetables such as onions, beans and peanuts.

2.6. Solar Driers

The solar driers utilise solar energy for drying the vegetables and fruit cultivated on the farm. This activity adds value to the agricultural products and higher prices may be obtained as opposed to selling produce fresh. The following products will be processed:

1. Fruit rolls from apricots, peaches and figs
2. Dried fruit from kiwi fruit, bananas, mangoes, figs, peaches, apricots and pineapples
3. Dried vegetables from beans, peas, peanuts, onions and tomatoes

An additional three driers must be purchased to increase the current output to 28kg every 3 to 4 days from the current output of 7kg.

2.7. Electrification of Community Centre

2.7.1. Sewing machines

Three Singer electrical sewing machines shall be purchased to begin automating the sewing activities. Power to operate these machines will be obtained from the electrification of the community centre. These machines will increase the production and improve the quality of the clothes manufactured by the community.

2.7.2. Lighting

Lighting and electrical points must be installed in all the rooms of the community centre. The community centre is a focal point of the village as it serves as an entertainment centre, education centre, church, crèche, shop and where all sewing and knitting activities take place. The DSTV shall also be located in the community centre. Lighting will provide illumination at night and during days of bad weather. The power points will be used to operate the new electrical sewing machines. There are a total of four rooms that need to be illuminated. The calculated luminance will be over 100 lux, which should be sufficient for sewing.

The installation has been designed to provide up to three hours of illumination in each room per day, with three days of autonomy. The system will be AC based. The installation will comprise:

1. Fourteen 75Watt solar modules
2. A 48V battery bank with a capacity of 376Ah
3. Seven double four-foot fluorescent lamps with individual pull switches
4. Three mains wall sockets
5. One 2500Watt DC to AC inverter
6. AC installation by a qualified electrician
7. Installation of one theft-proof solar module mounting frame
8. Stainless steel battery box with all solar related equipment
9. All installation, delivery, training and commissioning
10. Installation of the Galaxy 'Solar Sentry' alarm system.

2.8. Installation of Lighting for the School

Primary school is situated in the village, usually comprising of four classrooms and 180students. Lighting must be installed in all the classrooms, as well as three ceiling fans for cooling. Lighting will provide illumination at night and during days of bad weather. The calculated luminance will be over 100 lux, which should be sufficient for reading and writing at night.

The installation has been designed to provide up to three hours of illumination in each room per day, with three days of autonomy. The system will be AC based. The installation will comprise:

1. Twelve 75Watt solar modules
2. A 48V battery bank with a capacity of 376Ah
3. Seven double four-foot fluorescent lamps with individual pull switches
4. Three ceiling mounted fans
5. One 2500Watt DC to AC inverter
6. AC installation by a qualified electrician
7. Installation of one theft-proof solar module mounting frame
8. Stainless steel battery box with all solar related equipment
9. All installation, delivery, training and commissioning
10. Installation of the Galaxy 'Solar Sentry' alarm system.

2.9. Installation of computers and a DSTV system for the School

Five computers and a DSTV system are envisaged to be installed at the schools. The

DSTV can enhance learning by providing access to the Learning Channel on SABC TV (see The Star, Page 11, October 1 2001), as well as providing a VCR for viewing educational tapes. The computers will provide the students with the opportunity to begin familiarising themselves with the IT tools that they will use at senior school and beyond.

The DSTV installation has been designed to provide up to four hours of viewing per day, with three days of autonomy. The computer installation has been designed to provide up to four hours of operation per computer per day, also with a three-day autonomy. The system will be AC based.

The installation will comprise:

1. Fourteen 75Watt solar modules
2. A 48V battery bank with a capacity of 376Ah for the computers
3. One 12V 215Ah deep cycle battery for the DSTV system
4. One 2500Watt DC to AC sine wave inverter for the computers
5. One 350Watt DC to AC square wave inverter for the DSTV system
6. One 64cm colour television
7. One VCR
8. One DSTV decoder and satellite dish
9. AC installation by a qualified electrician
10. Installation of one theft-proof solar module mounting frame
11. Stainless steel battery box with all solar related equipment
12. All installation, delivery, training and commissioning
13. Installation of the Galaxy 'Solar Sentry' alarm system.

2.10. Establishment of a Solar Shop

A Solar Shop shall be started that will provide:

1. Maintenance, by trained personnel, for all the solar related equipment installed in the village
2. Spares for everyday failures
3. Upgrades as required for the solar home systems (for the home owners cost)
4. Routine servicing for the specialised equipment e.g. water purification system

Personnel will be trained and will be employed on a full time basis by the community. Salaries will be paid out of the trust fund. **R 25 000** is required to stock the Solar Shop with spares e.g. lamps, fuses, switches, solar modules for upgrades etc. and tools in accordance with NRS052-1. This includes VAT and transport.

2.11. Training and Upliftment

Qualified personnel with approved course material and documentation will present the courses at the village.

2.11.1. Sewing courses for new sewing machines

Three women from the community will be sent on a training course to acquire the skills for operating the new electrical sewing machines.

2.11.2. Solar related courses for the Solar Shop personnel

Two members from the community will be trained to operate and run the Solar Shop. The training will include:

1. Courses on solar energy technology and its application for domestic, production and processing purposes
2. Basic principles of electricity
3. Maintenance and fault finding practices necessary for maintaining the solar home systems in accordance with NRS052-1
4. Servicing techniques for all the specialised solar equipment

2.11.3. Upliftment

Training courses will be offered to members of the community to enhance their skills development, functional education and entrepreneurship. The courses will be conducted by SOLCEN in conjunction with VISTA University, Peace Gardens and Gauteng Technikon. The modules and their contents are defined as follows.

2.11.3.1. Management and Entrepreneurship 1

- Introduction to business
- Capacity Building 1

- Generating an income
- Business documents and records

2.11.3.2. Management and Entrepreneurship 2

- Capacity Building 2
- Starting and running an informal business
- Recording and Bookkeeping 1
- Marketing 1

2.11.3.3. Management and Entrepreneurship 3

- Capacity Building 3
- Starting and running a formal business
- Recording and Bookkeeping 2
- Marketing 2

2.11.3.4. Management and Entrepreneurship 4

- Capacity Building 4
- Managing a business and its legal aspects
- Recording and Bookkeeping 3
- Marketing 3

2.11.3.5. Applied Agriculture 1

- Introduction to Agriculture
- Systems Design
- Energy
- Nature, environment and conservation

2.11.3.6. Applied Agriculture 2

- Planning a production unit
- Managing soil and water
- Sustainable agriculture – General
- Plant Care (soil productivity and plant nutrition)

2.12. Project Management

A NGO shall be appointed to perform overall project management and co-ordination. The tasks will include:

1. Planning and liasing with the Project Management Committee of the village
2. Liasing with municipal and local government structures
3. Reporting on the project status and development.
4. Quality audits as applicable

2.13. Studies and Recommendations for Phase 3

NGO's will undertake a number of studies for the tasks and requirements identified as necessary for Phase 3 of the project. The studies will include a needs analysis, economic viability, financial sustainability, marketing plan, technical description and design and a quotation for implementing each of the tasks identified. The tasks are primarily for the development of commercial activities for the community. Each study will be presented in a report and will form the basis for estimating the funding required for Phase 3.

The following aspects must be studied:

1. Implementation of hydroponic irrigation and a hot house nursery
2. Establishment of a pilot biogas digester for the production of methane for cooking
3. Construction of a clinic to the requirements of the Department of Health
4. Electrification and equipping of the clinic
5. Establishment of a bakery for supplying bread and biscuits to the surrounding communities and towns
6. Establishment of a food packaging plant
7. Installation of an incubator for the rearing of poultry

3. PHASE 3

Objective

The objectives of the third phase are:

1. Determine the effectiveness of the second phase of the project
2. Implementation of the tasks as identified in 4.1
3. Development of the community into a 'model' and demonstrator for the Earth Summit

3.1. Requirements for Phase 3

Phase 3 seeks to extend the developments of Phase 2 in transforming the community into a more business and commercially viable entity that is self-sustaining and creating wealth.

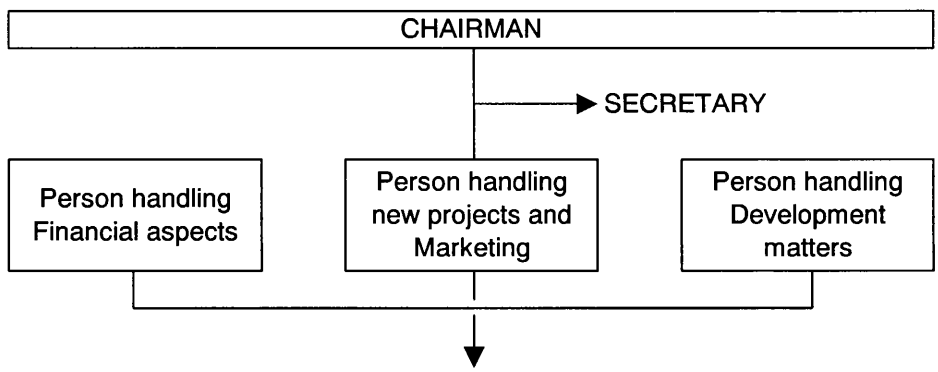
The recommendations of Phase 2 will influence the implementation of some of the tasks identified for Phase 3. These tasks are:

1. Installation of hydroponic irrigation (for the production of niche produce) and a hot house nursery for the cultivation of roses for export
2. Establishment of a pilot biogas digester for the production of methane gas for cooking
3. Construction of a Clinic to service the surrounding district
4. Electrification and equipping of the Clinic
5. Installation of a Hot Water System for the Clinic and the upgrading of the Hot Water System at the community centre
6. Installation of a Bakery for commercial purposes
7. Food packing plant for the packaging of processed fruit and vegetables destined for export or retail chains
8. Installation of waterless toilets at the school and the community centre
9. Electrification of the perimeter fence around the community centre
10. Erection of a perimeter fence around the school to protect the solar installation
11. Installation of an incubator for the rearing of poultry for protein and commercial purposes
12. Skills training in applied technology, food and textile technology and advanced sewing techniques
13. Providing access to SchoolNetAfrica for the learners.

4. Trust Fund (Referential)

A Trust Fund as used in the Rural Areas is outlined as follows:

- Consists out of a Trust Committee, consisting out of 5 members. This Committee is elected by the people of the village, at a Mass Meeting.
- This Trust Fund Committee is structured as follows(Leagal documents from the South African Government is used as a guide line):



- Report to community on the funding
- Business plans for new projects
- Financial control over funding
- Collect funding from the inhabitants of the village for empowerment purposes
- Pay salaries to those inhabitants who are working on projects in the village
- Deposit money obtained from the community – for future projets
- The Trust Fund is run by the people for the people.

The Transitional Local Government does also oversee the Trust Fund. This is important; then the Government is also aware of upliftment projects that is being done throughout the country. They record the project, but do not interfere with the activities of the project. The project is the "PEOPLES PROJECT".

Appendix 3

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Appendix 4

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