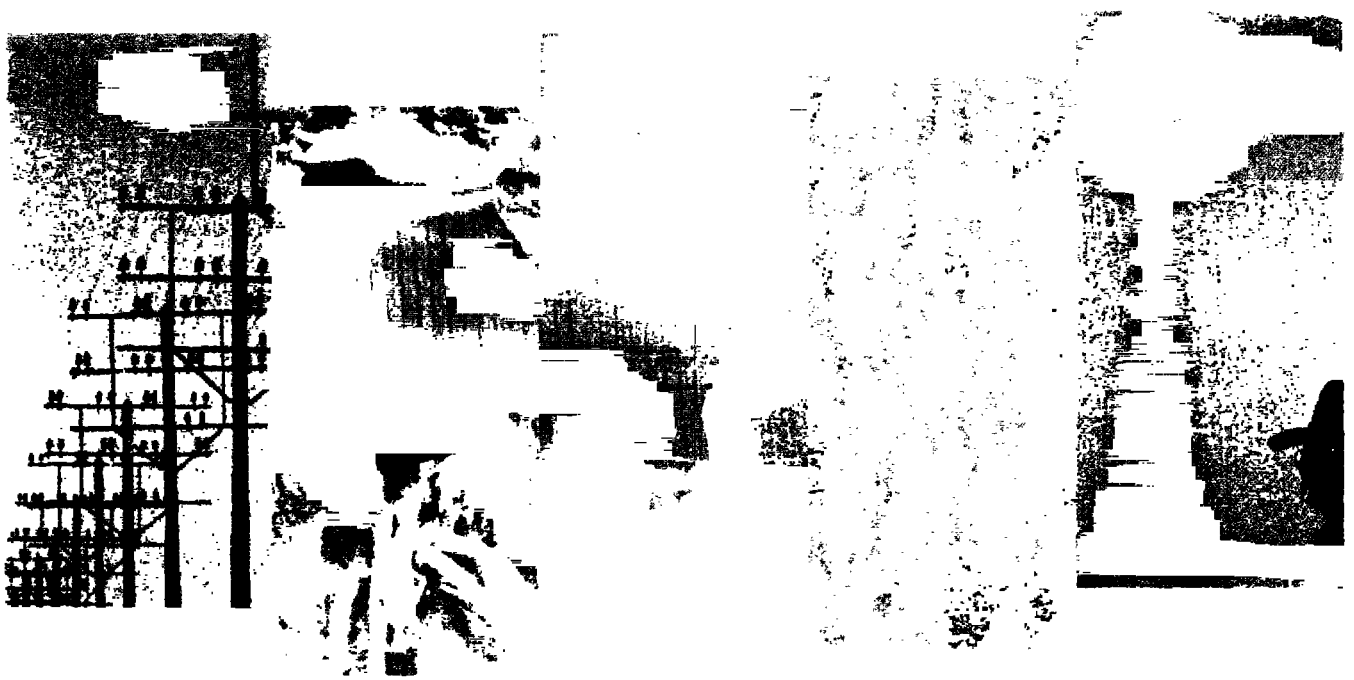
ESMAP TECHNICAL PAPER
019

Swaziland Solar Electrification Program 2001-2010
Phase 1: 2001-2002 (Solar Energy in the Pilot Area)



Energy

Sector

Management

Assistance

Programme

December 2001

ESMAP

JOINT UNDP / WORLD BANK

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

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(ESMAP)

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ESMAP Management"

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Summary

In this report a solar electrification programme for Swaziland is presented. The programme focuses on the implementation of solar electrical systems to meet basic electrical needs of the rural communities of which currently less than 5% is connected to the grid electricity.

Although various solar implementation efforts have been undertaken to date, there are still a number of factors constraining the development of a sustainable solar market in Swaziland. The major barriers are:

- rigid product assortment, focusing mainly on complete solar home systems;
- focus on PV technology instead of service delivered
- finance facility only accessible to the high income groups.
- limited awareness;
- perception barrier
- limited retail and service infrastructure.

The proposed programme tackles these barriers. The programme will start in one geographically confined area. With joint efforts of both local and international experts a comprehensive implementation strategy will be carried out in the selected area. The strategy will start with a needs assessment to investigate priority applications, both domestic and productive. The outcome will be the bases for developing a wide range of products and solar delivery modes. After two years the program will be evaluated and expanded if successful. The long-term objective is a sustainable market for solar energy, supported by the rural population, the policy makers and the national utility. Expected benefits of the program are:

- improvement of the overall standard of living in rural areas;
- increased opportunities for productive activities;
- reduction in the household energy expenditure;
- reduction in political and financial pressure on government to provide electricity to all by 2020.

Creation of awareness at difference levels will play a key role in this project, as getting solar accepted by the rural communities, the government and the electricity utility SEB is critical to the sustainability of the program.

Particular attention will be paid to internalizing the concept of solar energy within the national electricity utility SEB. To start this internalization process a specific solar scheme for SEB employees is proposed. Although this scheme is not directly linked to the solar electrification program presented here, SEB's support to the solar market development process is considered valuable for long-term sustainability. Moreover, the fact that SEB is providing solar systems to its employees will give a clear signal to the general public that solar indeed can cater for electricity needs.

The deliverables of this solar electrification program include:

1) A needs assessment in the pilot area, with a focus on energy needs for productive and community activities;

2) The development and implementation of wide range of solar products, delivery modes and promotion strategies;

3) Monitoring and evaluation of solar energy uptake, energy use, energy expenditures and user satisfaction compared with baseline conditions;

4) Working at a national policy level to affect a shift in the rural electrification policy; 5) Production of a report every six months to keep stakeholders briefed on developments and project progress and to disseminate information on the lessons learned.

1

Introduction

1.1. Background

Swaziland is a relatively small country with a well-documented and researched energy situation. Over the past decade several initiatives on a small scale were initiated to market PV. The present proposal is based on the lessons learned from these initiatives and during the Netherlands Energy Research Foundation's ECN's long-standing presence in Swaziland. The aim of this program is to turn the country into a showcase of successful rural electrification with PV. It will show that substantial improvement in quality of life is possible without extending the grid into all corners of the country.

In a rural household energy study in 1993, a large potential for solar energy was indicated. At that time only 3% of the rural population was connected to the grid and this figure has hardly changed over the years. The reason is simple: the rural population in Swaziland is settled in a very dispersed manner. There are no villages and households are spread out all over the countryside. To have the electricity-grid reaching each an every of these scattered households is an extremely costly affair. Unless the Swazi are willing to resettle, having everybody connected to the grid in the foreseeable future seems rather unrealistic.

Given the abundance of sunshine in the country, a stable political setting, and a relatively high GDP per capita, the potential for solar energy seems high. The above mentioned rural household survey indicated that at least 20,000 households, corresponding to 20% of the rural population, could afford a solar electrical system, provided some form of finance would be available. With these facts in mind a solar implementation project was set-up in 1997. Together with the local company Swazitronix - who for long has been the sole supplier of solar systems in the country, but never managed to break through - the dissemination of solar system was given a new impulse. A new venture Solar International Swaziland (SIS) was established and with the support of the Triodos bank (Netherlands) a credit scheme was developed and a promotion campaign was implemented.

However sales were below expectation. The project had aimed at commercially disseminating 500 systems in the first year, managed to sell and install approximately 200 systems only. Similar numbers were sold in the following year. To understand the slow

speed of the market uptake, a solar market evaluation was carried out in 1998. Based on this evaluation, various shortcomings in the applied approach were identified (Lasschuit 1999).

Combined with recent literature (Cabraal, Cosgrove-Davies et al.; Martinot, Cabraal et al. 2001), the main factors limiting PV dissemination in Swaziland are:

- rigid product assortment, focusing mainly on complete solar home systems;
- focus on PV technology instead of service delivered
- finance facility only accessible to the high-income groups.
- limited awareness;
- perception barrier
- limited retail and service infrastructure.

With the financial support of the World Bank these issues were addressed and the results so far are encouraging. Although there is still a long way to go, it seems that Swaziland is heading in the right direction. The product assortment has been broadened and includes smaller and hence more affordable systems and components. The sale of smaller systems has increased significantly. Still, the turnover of Solar International Swaziland doesn't generate sufficient cash flow to invest in large-scale promotional campaigns or expansion of the infrastructure.

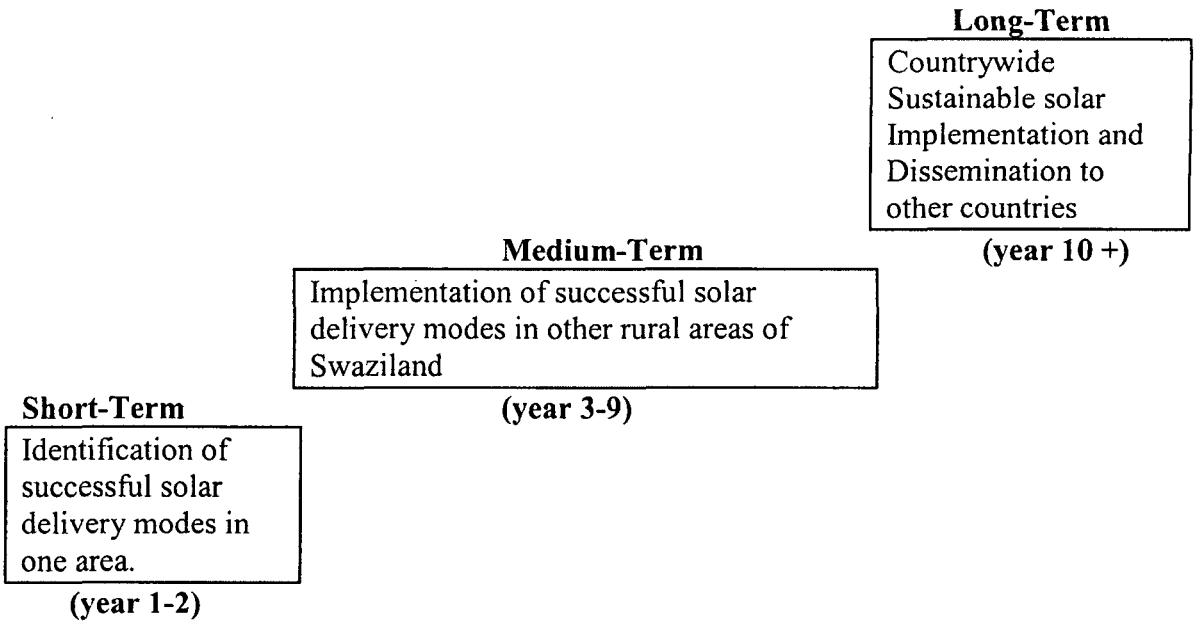
The achievements of Solar International are nevertheless commendable, especially when compared with the results of many other heavily supported solar implementation programs in the rest of the world. With a very limited subsidy –most support received was in the form of a) a repayable loan from both the Triodos bank and the World Bank and b) human resources (ECN) - it managed to disseminate some 700 solar systems.

It seems that Solar International Swaziland has set about in the right way. The fore laying program proposal builds on the foundations that have been laid in the country and will address the barriers identified to hamper the take off of PV in Swaziland. Main attention will be the area orientation as well as offering of end-user applications instead of PV technologies.

1.2. Objectives, activities and benefits

The ultimate goal of the presented program is to improve rural living conditions by increasing access to off grid electricity options in a sustainable way. The short, medium and long-term objectives are presented below.

Ultimate Goal: Improvement of Rural Living Conditions



To achieve the ultimate goal the following activities are envisaged:

1) to identify both the productive and domestic energy needs in a restricted geographical area by

- developing and disseminating tailor made solar electrical packages to meet these needs;
- developing and implementing a range of finance facilities for the solar electrical packages;
- monitoring and evaluating the solar energy uptake;

2) to develop an institutional and financial setting that will ensure sustained market growth;

3) to enhance local capacity to deliver energy services to end-users;

4) to create awareness among policy makers and end-users.

5) to identify most viable solar electrical packages and to develop a phased implementation plan for expansion of similar services in other areas;

The expected benefits of the proposed program are:

- *Improvement of the overall standard of living in rural areas* -- There are numerous studies that reveal the positive impact of solar electricity on rural living standards. Often quoted welfare effects are e.g. time liberations, increased reliability and convenience in energy use, decrease in indoor pollution, and accidental fire, improvement in health and hygiene, and better education opportunities.

- *Increased economic activity* -- Although up to now the impact of solar electrical systems on economic activities has remained limited, the potential is high. Firstly, there are the local employment effects of the diffusion of the solar systems. Secondly, there are economic values related to e.g. improved access to weather reports for productive purposes,. up to date market reports delivered via television, radio and telephone services. Thirdly, there are economic gains from extended lighting hours, e.g. extended shop opening hours, lighting for poultry breeding to speed up breeding process. Lastly, the use of electric appliances can both improve efficiency (e.g. electric sewing machines) and create new economic opportunities (e.g. rural cinema, rural secretarial service).

- *Reduction in household energy expenditures* -- The potential savings of solar electrical systems on energy expenditures can be considerable. People tend to spend fortunes on dry-cell batteries, charging of car batteries, candles and paraffin. Although often part of the savings is off set by increased energy use- rather than total substitution - the overall expenditures generally decrease.

- *Reduction in political and financial pressure on government to provide electricity to all* -- The Government's long-term objective is to have everybody electrified by 2020, mainly by grid-extension. However, there are neither concrete plans nor budget allocations that could make this happen. The proposed program could set an example and actually contribute to achieving the aim of electricity for all.

1.3. From solar electricity to rural energizing

The proposed activities in this document focus on the first two years of the program. Attention will be focused on the implementation of solar driven energy applications in a restricted geographical area. Ultimate aim of the program is to show that rural energizing is possible without by default extending the grid. In order to make it possible for the program to extend the energy provision to, for example, the use of LP gas for heating and cooking, from the start all energy demands are taken into account. Proposals for these extended energy services will be submitted separately.

1.4. International dissemination

The program as presented here focuses on Swaziland. After a successful start in the pilot area, the program will expand into other areas in Swaziland. The case of Swaziland and this program for rural electrification can serve as a showcase and demonstration project for other countries in and outside the region. ECN will actively look into the possibilities for international dissemination of the lessons learned in Swaziland. To this end a project will be defined, and funding sought, to build a digital "shop window" to expose the Swazi solar experience towards the outside world.

ECN strives to apply the lessons from the Swaziland program in other countries in Southern Africa, starting with Mozambique.

2

Towards a Sustainable Solar Market Development

This section provides an overview of what is still lacking for a sustainable solar market development in Swaziland and what is needed to overcome these shortfalls.

2.1. Gaps in the solar market

2.1.1. Product range

In Swaziland like in many other developing countries, high quality solar home systems (40-50Wp solar kits, suitable for 3-4 lights, and B&W television) have been promoted. Given the heterogeneity in demand and income levels the provision of one standard system clearly doesn't suit everybody's needs and budget.

In the few countries were a commercially viable solar market has emerged, such as Kenya and Zimbabwe, the key leading to this development is embedded in 'small and cheap'. The market is dominated by small panels (10-20 Wp), bought as single components and connected by the end-users to car batteries used mainly for television and lighting.

Last year the product range in Swaziland has been expanded to include such smaller panels. This has resulted in significantly higher sales, but no commercially sustainable turnover has been reached yet. For a commercially sustainable business not only smaller systems but other related products need to be incorporated in the product range. A refocus on more productive applications such small water pumps, wireless communication and small tools employed in rural production processes could help in this regard. Evidence from South Africa indicates that such an appliance-oriented marketing generates better results than focusing on solar only. Especially the sale of small PV powered water-pumping systems do very well.

2.1.2. Finance

Recognizing the need for consumer finance, a foreign supported solar credit facility was established in 1997. The fund induced a significant increase in the turnover of the systems of higher capacity and better quality. It clearly proved that lowering the financial threshold contributes to higher sales. The limitation of the credit facility were:

- limited to standard solar home systems;
- limited to those in paid employment

Tackling these limitations will no doubt mean a boost in sales. Efforts to finance the so-called 'unbankable' people through the local banks have so far failed. The relatively low amounts of the loan, high administrative costs and lack of traceable credit history all contribute to the attitude of the commercial banks. With the increasing integration of rural areas into the money economy, the need for finance is only increasing. Various informal finance structures exist ranging from 'shylocks' with interest rates of 100% not being uncommon to self help schemes set up by and for the people, such as rotating finance schemes among women groups. These informal structures thrive and indicate that rural people are 'bankable' after all, but may require an unconventional approach. Clearly this requires some risk taking and daring financiers, who are generally difficult to find.

2.1.3. Awareness

During the past decade the Swazi government, donor agencies, and the private sector have implemented numerous solar promotion activities. All these activities have raised awareness about the solar technology in general, but the knowledge amongst potential users often remains superficial and generally lacks the details necessary to make actual investment decisions. Moreover, due to the limited number of retail outlets in the country, many people don't know where to go for more in-depth information.

Another shortcoming has been a bias of promotional activities to solar systems for domestic use, leaving out the commercial sector such as rural shops, restaurants, market halls, farmers, and nature reserves. Clearly, finance may be less of a problem for the commercial sector. The investment in a solar system could in many cases earn itself back. Tapping this ignored target group could contribute to a substantial market growth.

2.1.4. Infrastructure

There are about 8 solar retailers active in Swaziland at present, of which only one, Solar International Swaziland, is specialized in solar equipment. Very few of the retailers offer installation, and after sales service. Many studies worldwide have shown that after-sales-service is crucial for the solar market to flourish. Although Swaziland is relatively small, it will need to expand its existing service infrastructure to reach a wider audience.

Looking at the presently installed systems there is a clear concentration around Manzini, were the main supplier of solar systems is located. For people to invest in a solar system, they need the security of technical support in case of problems. Expanding the service infrastructure is a necessary condition for the market to grow, but like indicated the present demand is too limited for commercial entrepreneurs to invest in costly infrastructural expansion.

2.1.5. Institutional support

Solar energy as a viable option for rural electrification is not 'alive' among policy makers. This becomes evident when looking at the rural electrification policy that is currently being formulated. The first draft didn't contain a statement on off-grid electrification at all. Only through small renewable energy lobby and 'off-grid' electrification component was included. The stance on off-grid electricity options still remains vague and open ended. In line with this the allocation of the resources are primarily focused on grid extension and only ..." those facilities unlikely to be connected to the grid in the medium to long term should be targeted for off-grid systems....".

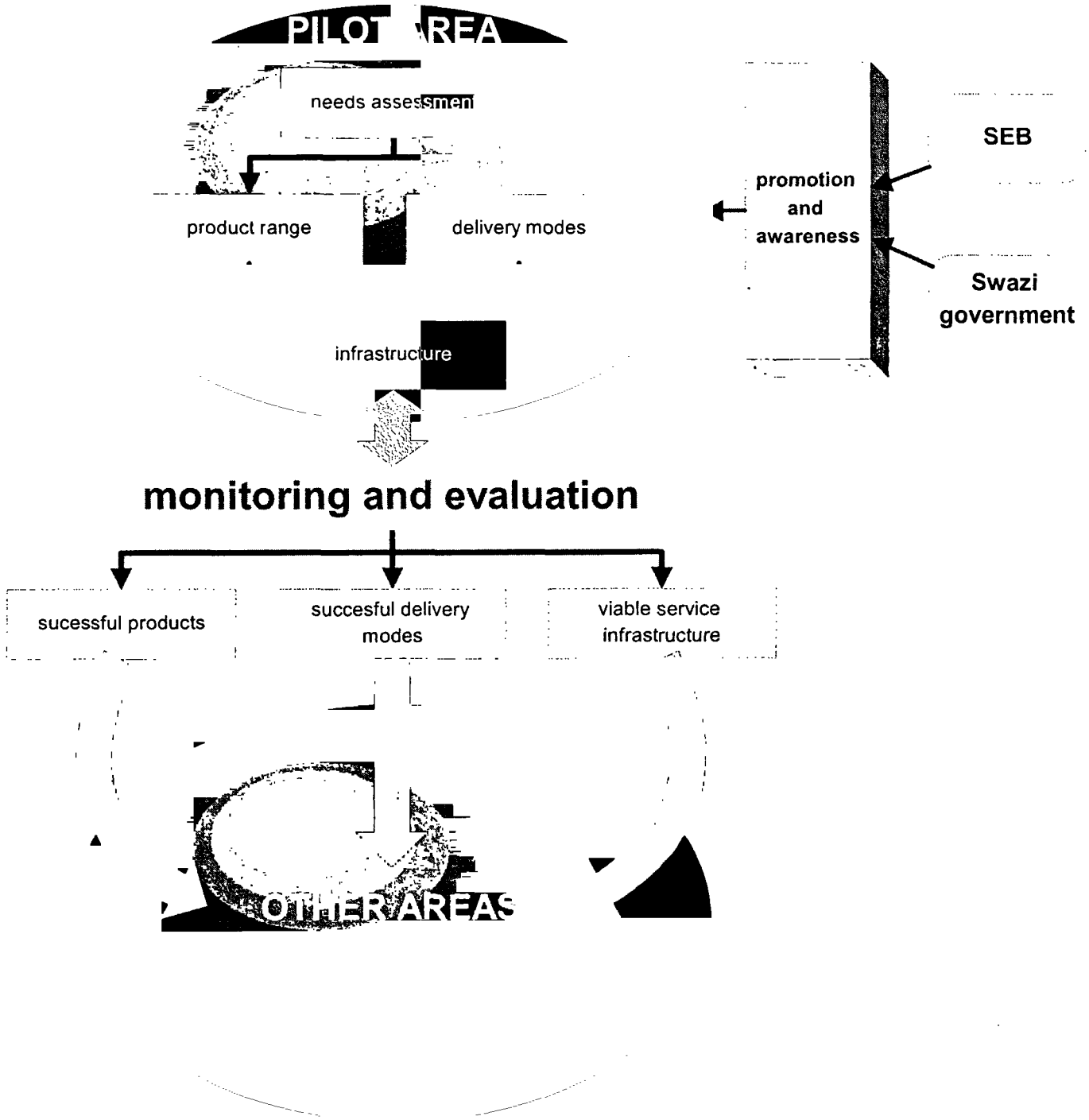
The same situation applies to the national electricity utility SEB. With the ongoing privatization process, however, alternative 'off grid' solutions for rural areas may become a reality or even necessity. With an increasing pressure to economically perform, SEB needs to focus on those activities that are profitable. At top level within SEB there is interest to participate in viable off-grid electricity activities. But at lower levels within the organizations solar energy and other off-grid options are still met with hostility. They are viewed as being in direct competition with the grid and therefore a threat to job security.

Although the direct involvement of SEB may not be necessary for the solar market to thrive, immense benefits could be reaped from SEB's commitment to solar. Furthermore, with SEB making clear statements on which areas will not receive grid extension, people will get clear messages that waiting for the grid is idle hope and will increase motivation to invest in off-grid electricity.

2.2. What needs to be done?

The above indicates that there is still a long way to go before all the necessary conditions for substantial market growth are in place. Many things have been tried or set in motion, but only on a small scale. To make real impact all the above aspects need to be addressed simultaneously. So far this has not happened. The activities in the past were generally single focused. The present program tries to follow an integrated approach. It will start in one geographically confined area, which will receive a complete package of solar energy related activities. By focusing on one area, it becomes possible to assess in depth the needs of the people and tailor the products and services accordingly. Moreover, the concentration of installed systems will make it possible to build a viable service infrastructure in the area, thereby enhancing the system performance and user satisfaction. Lastly, the concentration of a large number of solar systems in one area will receive a lot of exposure thereby attracting the attention of policy makers who up to now had a rather passive or grid biased attitude.

After a pilot period of two years, in which various products and delivery modes have been tested, a step like plan for scaling up the market activities will be introduced. The proven success will make it easier to attract the commercial sector and generate interest to invest in expansion of the market. Moreover, a successful outcome of the pilot may also convince the Government and make them willing to set aside funds that could support further market growth - e.g. subsidised finance scheme for the poor.


PILOT AREA
needs assessment
product range
delivery modes
infrastructure
promotion and awareness
SEB
Swazi government
monitoring and evaluation
sucessful products
succesful delivery modes
viable service infrastructure
OTHER AREAS

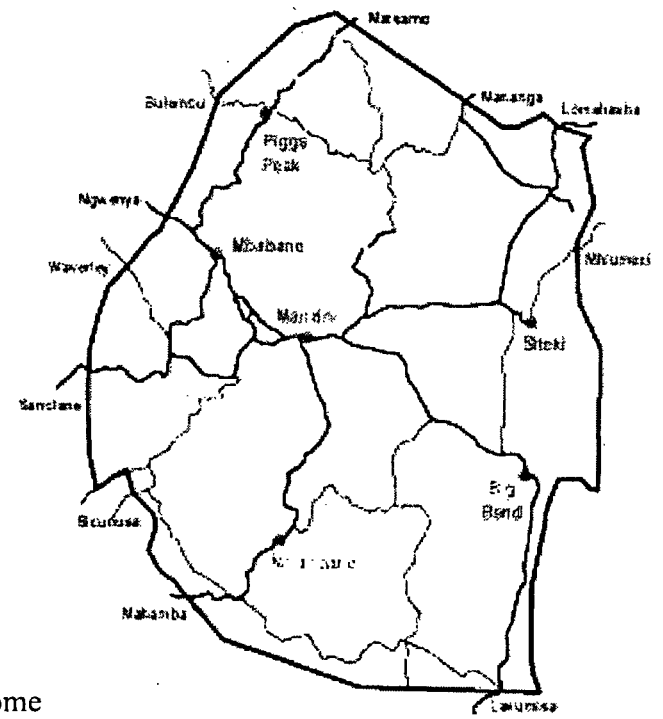
3

The Action Plan

In this section an overview is given of the activities, responsible parties and required budget for the first two years of the program. A detailed breakdown of the budget for each activity is presented in Annex 1.

3.1. Pilot area selection

The program will start in a geographically confined area in which by means of a range of products and delivery modes it will be shown that rural electrification with PV is a viable option. As this first area serves as a testing case and will determine the success of the follow-up activities, success is crucial.



Based on past experiences three potential areas have been selected. In these three areas a baseline energy survey has been carried out some years ago. All three areas are rather progressive, have a relatively high share of middle and high-income groups and are good accessible from the main centers.

The proposed areas are Ntfontjeni, Mahlangathsha and Luve. The final selection of the area will be based on achieved development since the baseline energy survey. A simple

objective quantifiable indicator will be used for this selection process. After selection the communities concerned will be visited and their co-operation requested.

Action 1:	Area selection
Duration:	2 weeks.
Starting date:	at start of the project
Key activities:	objective quantifiable development indicator selection community meeting(s)
Output:	selected pilot area
Total budget:	US$ 2580

3.2. Needs assessment

The needs of and willingness to pay for energy services by the end-users will serve for determining the product range and tailoring delivery modes. The overall household energy needs are already quite well known (Lasschuit and Westra 1994; Lasschuit, Westra et al. 1996; Lasschuit 1999). The assessment will therefore primarily be an update of the existing data and used to see whether changes did occur. For the first phase of the program the emphasis will be on energy demands that can be substituted by solar electricity. Extensions of the program might look into the provision of gas as well to cover the whole energy demand.

Action 2:	Needs Assessment
Duration:	6 weeks
Starting date:	two weeks after start of the program
Key Activities:	- Identification of existing materials - Development of questionnaires - Community meetings - Survey among sampled households and commercial sector - Data entry and Analyses - Reporting
Output:	Report containing the identified needs and affordability of the end-users. Output will be used to determine product range and tailor delivery service.
Total budget:	US$ 10590

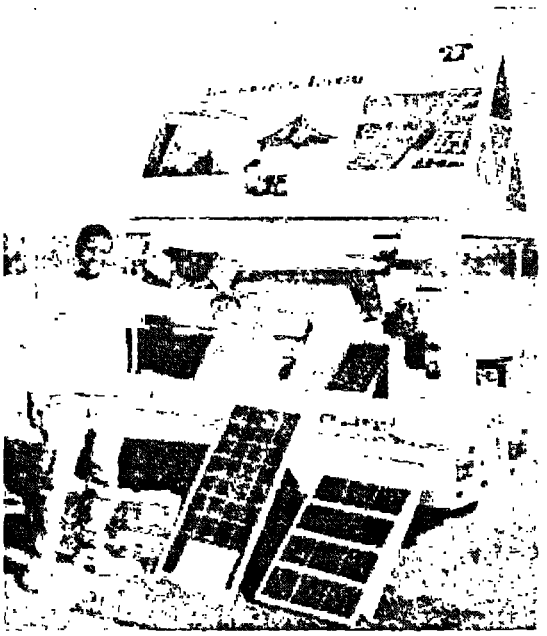
3.3. Product range and promotion

Based on the outcome of the needs assessment the product assortment will be defined for the identified applications and suitable promotional materials will be developed. In both the product range and promotion the application rather than the solar power will be the focus. This has the advantage that people know straight away what to expect from the solar power pack. Per application, a solar power pack will be designed. The result will be that rather than designing one large system that could serve more than one application, the emphasis will be on one solar power pack per application. Some examples of such packages that can be supplied either as a kit or as single components are:

- multi-media power pack (rechargeable NiCad batteries, a PV NiCad battery charger for charging a radio, discman or walkman);
- cell phone pack (cell phone with solar power pack and charge cables for both car use and connection to the solar charge system);
- security pack (outside light with movement sensor, alarm and solar power pack).
- water pumping system (water pump, controller and solar power pack)
- powering computers for domestic use as well in schools and offices

For promotional purposes it is envisaged to build a demonstration trailer similar to the one that has successfully been used for promotional activities in Botswana (see fig.1)

Figure 1: Promotional Trailer Botswana



Action 3:

Duration:	8 weeks for the initial development but adaptations are possible throughout the program, based on gained experiences
Starting date:	1.5 months after the start of the program
Key Activities:	Development of solar product packages Development of packaging, users manuals Development of promotion/demonstration trailer
Output:	Assortment of appliances and solar power packs tailored to needs of the people Promotion trailer and other promotional materials
Total budget:	US$ 50250

3.4. Development of delivery modes

Given different income levels, priorities and risk attitudes, tailor made delivery modes needs to be developed for the identified product range. The most common delivery mode is *cash.* It reduces the risk of non-payment to zero, it minimizes the administrative cost

and puts minimal strain on the company's cash flow. For the buyer a cash sale means no extra finance charges and no monthly repayment obligations. Cash sales will obviously be among the implemented delivery modes.

To reach more than the limited number of buyer who can pay cash other payment methods to reduce the upfront cost have to be implemented as well. Below a range of envisaged options are summarized with increasing level of financial access. The first step down is a *lay bye system*. This is only a slight diversion of the ordinary cash method. Lay-bye is a common method of paying for high cost commodities (furniture, electronic equipment and clothes) in Southern Africa. It implies that customers deposit regular savings for a predetermined period of time as a pre-payment on the purchase. It has similar advantages as the cash payments: no extra financial charges for the customer and no risk for the supplier.

The next step is a *credit system*. Whereas the lay-bye method makes it possible to spread cost over limited period of generally not more than 3 months, a credit scheme can further reduce the upfront investment by allowing for a longer payment period. Experiences in Swaziland with direct customer credit for solar systems have already proved the positive impact of such a scheme on sales. Building upon the experiences with the credit systems, credit will not be limited to large solar home systems only and will also allow those without regular cash income to enter the scheme. The higher risks, associated with the loosing up of terms and condition of the credit scheme will be off set by:

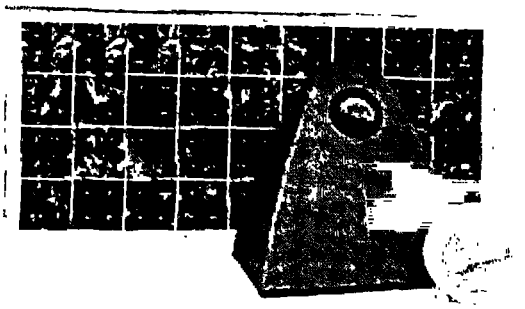
- intensive and creative payment collection methods; and
- the implementation of group schemes, with individual responsibility for the collective repayment. Such schemes work well among women groups and hence may work well for solar systems since women are generally the main beneficiaries of the system.

A variation of the credit scheme is a *rent-to-own scheme*. With a credit scheme ownership is normally passed on to the buyer at the moment of purchase, whereas with a rent-to own scheme ownership remains with the system provider and is only transferred to the user after a certain period or after payment of a certain amount of money. In practice though the differences are very minimal since even with a credit scheme the provider normally holds the right to repossess the system in case of defaulting.

Further down the line is a pure *rental scheme*, in which ownership will always remain in the hands of the system provider and will never be passed on the end-user. Although this rental scheme has been implemented in several countries, the perception is that people prefer to own the system in the end. Various surveys in Namibia, Swaziland and Zimbabwe have confirmed this perception. An additional advantage of a rent-to-own system is that the end-user may take better care of the system, knowing it will be his or hers in time.

3.4.1. Products

In the pilot phase at least two products will be incorporated that have been designed with a view to rental or rent to own: a 50 Wp solar home system and a solar lantern both with built-in pre-payment device.



Shell Renewables South Africa -part of the Royal Dutch Shell group - together with the South African electricity utility ESKOM, has distributed about 6000 of the so-called PowerHouse ® systems in the Eastern Cape (SA). The Power House system includes a solar panel, battery and controller, four lights and wiring. The customer pays for the use of the system, by buying a pre-coded magnetic prepayment card from a nearby outlet. For such a rental scheme to become sustainable, the fee should cover maintenance and depreciation cost and should include an overhead component as well. Given the pilot nature of the project in the Eastern Cape the current fee of R 52 per month is not fully cost reflective yet. The project has recently finished its initial phase and is in the process of evaluation. An impressive number of systems have been installed in a relatively short period of time. Of course lessons can be learned from this phase. A major disadvantage - perceived by end-users - has been that one pays for having the system at home and not for the electricity actually used. Similar complaints can be expected in Swaziland and it is therefore envisaged that the PowerHouse system will be improved on basis of the ongoing evaluation. The South African consortium has expressed its interest in participating in the program.

An other product is the Logic Lantern, which is more or less based on the same principles as the PowerHouse ®. The lantern comes with a prepayment device that secures payment before use. The prepayment device can also be disabled when ownership is transferred.

A product focused on the segment at the bottom of the income scale that could still be commercially viable is the set up of a rural *battery charging* facility. Such a facility, whereby people can charge their batteries within their own community, rather than traveling all the way to the nearest town, has been successfully applied in varies rural communities in South Africa. There have been earlier attempts in Swaziland to get such a facility off the ground, but due to the lack of finance for the purchase of such a battery charger, it never materialized. Within this program therefore, finance will be secured for the investment in such a facility. Depending on the utilization of the facility, the payback time of the investment can be relatively short. To make the investment most attractive for a local entrepreneur, a repayment scheme will be

developed in line with income generated. The implementation of delivery modes is closely linked to the building of a support infrastructure, which will be dealt with in the next section.

Action 4:	Development of delivery modes
Duration:	2 years
Starting date:	2 months after start of the program
Key Activities:	Development of a range of delivery modes
Output:	A cash scheme, credit scheme, rental scheme and battery charging facility
Total budget:	These activities are all commercially viable and the cost should therefore be carried by the implementing parties. Only, finance will be needed for the credit and rental scheme and battery charging facility. The total loan need is estimated at US$ 255000

3.5. Building of a support infrastructure

For the various delivery modes to become successful an appropriate support infrastructure is needed. For all delivery modes it is considered essential to have an outlet in the target area. This outlet will intermediate between the end-users in the area and the main supplier in town. The outlet will hold a limited number of stock, places orders, delivers products and collect money from the end-user. This outlet should preferable be an existing commercial enterprise like a rural spaza. Previous attempts to set up such an intermediary outlet were unsuccessful. Experiences have lead to possible improvements. For the pilot area it is therefore considered to set up a dedicated shop with adequately trained staff. For the establishment of such a rural service center the use of a prefab container type of building is envisaged. The advantage of such a prefab structure is that it is easy to transport, immediately ready for use and easily extendible. One experienced sales person and one assistant will staff the shop. In addition two local technicians will be trained in the installation and maintenance of the range of products on offer. In the first two years of operation regular inspection the technician to all systems installed in the project area envisages visits. The lessons from the past have learned that such visits highly contribute to proper performance of the systems and therefore increase user satisfaction and success rate of the program.

Action 5:	Support infrastructure
Duration:	2 years
Starting date:	1.5 months after start of the program
Key Activities:	set up retail and service outlet training of local technicians
Output:	effective support infrastructure in the pilot area local capacity
Total budget:	US $ 12875

3.6. Institutional support

One of the objectives of the pilot phase is to show both the Government and national utility Swaziland Electricity Board (SEB) that solar electrification is a viable electricity option in rural areas. For the long-term sustainability of the program the support of both

parties is considered essential. Especially the national utility could play a useful intermediary role. SEB could take away the illusion prevailing in some areas that the grid may come there one day. Convincing the people that it is useless to wait for the grid may make it easier for the alternatives to be accepted. SEB receives many grid applications from people in rural areas. Current practice is to turn these applications down. For these rejected applications, SEB could offer solar electricity as an alternative. This will benefit not only the end-user but will also boost the image of SEB.

To make this happen, SEB staff first needs to be aware of the alternative. The knowledge of solar energy within the organization is still very limited and often biased. Some see solar electricity as being in direct competition and a threat to job security.

To take away such misconceptions and to internalize the concept of solar energy into the organization, a series of workshops are envisaged as well as an internal project whereby staff members can buy solar systems for themselves at reduced rates. Although most of SEB's staff is connected to the grid, many have relatives in unelectrified rural areas or are building houses in their home area with a view to their retirement.

Action 6:	SEB Awareness program
Duration:	2 years
Starting date:	March 2001
Key Activities:	Solar workshops and implementation of subsidies solar purchase scheme for SEB staff.
Output:	Increased awareness among and support of SEB staff regarding solar electrification
Total budget:	US$ 91500

3.7. Co-ordination, monitoring and evaluation

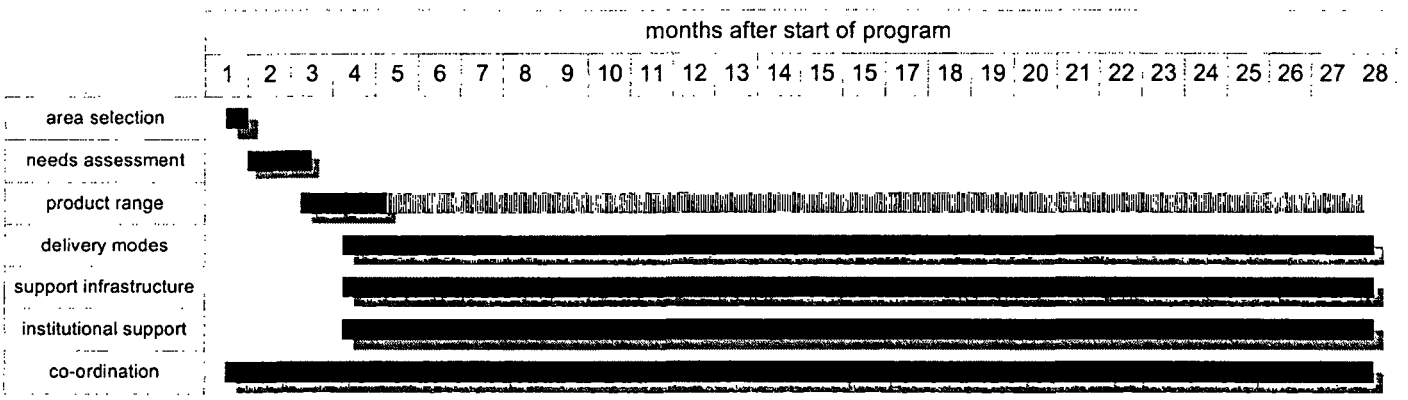
A driving force to get everybody into gear and maintain the momentum is considered essential for the success of the program. A dedicated co-coordinator is needed to prevent the involved parties loosing focus and drift away in separate directions. The organization would bring project management, technical, financial, and market assessment experience, as well as contacts in Swaziland, Southern Africa (private, public and informal sectors), and internationally (private sector and government).

Action 7:	SEB Awareness program
Duration:	2 years
Starting date:	start of the program
Key Activities:	coordination, recurrent fields survey among end users
Output:	Report in which pilot phase is evaluation and follow-up program is presented in case of a successful first phase.
Total budget:	US$ 102,000

4

Timeframe

In the graph underneath the proposed activities are displayed on a timeline. The total duration of the first phase is two years.



5

Program Partners

The following are brief descriptions of the potential partnership organizations that are committed, or have shown an interest to contribute to developing the solar market in Swaziland.

5.1. Netherlands Energy Research Foundation ECN

ECN: a leading international institute in the field of research in renewable energy related technology and policy issues. ECN is located in Petten, the Netherlands. The Implementation of Renewable Energy (REI) team of ECN draws on the skills, the knowledge and research and test facilities of this broad base of technical specialists. The REI-team has extensive renewable energy experience and knowledge and is active in Southern Africa, in West Africa, Asia and Central and South America and has regional offices in Botswana and Swaziland.

ECN main interest in the program is the development of successful implementation strategies, and the opportunities the program gives for longitudinal research on the relation between rural energy provision and development, and the technical performance of the solar systems over time.

5.2. Solar International Swaziland

Solar International Swaziland is a local PV implementing agency with a clear social mission. The company was founded in 1997 and has successfully sold and installed approximately 700 solar systems in Swaziland. The new PV credit facility and rental scheme is a unique opportunity for SIS to disseminate PV Systems on a larger scale. Recently Solar International Swaziland has recruited two starting entrepreneurs from the Netherlands with a professional background in marketing and public relations as well as infrastructure planning. Both have been involved in various projects in developing countries (Ethiopia, Uganda, and India).

The rural electrification program gives SIS the opportunity to extend their market to the required size of 3000 to 5000 systems needed for profitable business running.

5.3. Swaziland Electricity Board

SEB is a Government owned parastatal, although presently undergoing a privatization process. It has overall responsibility for supplying electricity in Swaziland and employs about 700 people. Since 1963 SEB has had the monopoly to provide electricity and to grant licenses to other operators to generate and/or distribute electricity. The total annual electricity generated and purchased is about 800 GWh. Of this total some 70% is imported from South Africa. SEB is keen to participate in the program as it might help them to "green" their image and helps them to develop more cost effective means of rural electrification than the traditional grid extension.

5.4. Shell Renewables South Africa

Shell Renewables South Africa is a new business within the Shell Group and constitutes a fifth core business to sit alongside Shell's traditional oil exploration, production, products, chemicals, gas and coal sectors. It aims at investing some US$500 million into renewable energy technology in the next five years to tap an expected explosion in demand for environmentally friendly power. In 1998 it entered into a joint venture with the South African electricity utility Eskom to develop the PV market in South Africa. Systems adapted from the South African PowerHouse systems might be used in the proposed program in Swaziland.

6

Budget Summary and Funding Requirements

6.1. Budget summary

Action	Budget (US$)
action 1: area selection	2580
action 2: needs assessment	10590
action 3: product development and promotion	50250
action 4: delivery modes	255000
action 5: infrastructure	12875
action 6: SEB awareness program	91500
action 7: Monitoring and evaluation of pilot phase	102000
contingencies (6%)	35205
TOTAL BUDGET	**560000**
total finance requirement	330000
total funding requirement	230000

6.2. Finance requirements.

Finance is needed for Action 4 and 7:

- working capital and finance for credit/rental scheme: US$ 255000
- finance for SEB scheme: US$ 75000

A finance proposal for the total amount of US$ 330000 will be submitted to Triodos bank.

Triodos Bank has previous supported the set up of credit facility in Swaziland. The previous loan from Triodos bank has been repaid in full, and the bank has indicated to be willing to consider new loan applications.

6.3. Funding requirement

Total remaining budget that needs funding amounts to US$ 220000. The following contributions are envisaged. :

Funders	US$
World Bank[1] 1	78,500
ECN	78,500
Other sources	73,000
TOTAL	**230,000**

ECN, as program co-coordinator, will put in effort to find funding for the remaining US$ 73,000. Several potential funders have been approached already and we are confident to find parties interested to participate. As said in paragraph 1.4, additional "add on" projects will be defined to make optimal use of the potential synergy with this program.

[1] The World Bank gave an interest free loan to Solar International of US$ 100000, to be paid back in 18 months in Rands. At the time the loan was received exchange rate was about US$ 1 =R 6. The World bank has indicated to be willing to reinvested this money again in the solar market development in Swaziland. Due to the devaluation of the Rand the dollar equivalent of R 600000 today is about US$ 78500.

7

Budget Specifications

7.1. Action 1: area selection

Task	Cost category	Unit	No. unit	Cost/unit US$	TOTAL US$
area selection	International consultants	day	2	600	1200
Communitys meetings	International consultants	day	2	600	1200
	Travel	km	600	0.3	180
Total Cost					**2580**

7.2. Action 2: needs assessment

Task	Cost category	Unit	No. unit	Cost/unit US$	TOTAL US$
Community meetings	Local consultant	day	3	200	600
	SIS	day	3	25	75
	Travel	km	600	0.3	180
Development &	Int'l consultant	day	1	600	600
Testing of questionnaire	Local consultant	day	2	200	400
	Travel	km	200	0.3	60
	Printing				75
Survey	5 enumerators	day	15	100	1500
	Local consultant	day	4	200	800
	SIS	day	10	25	250
	Int'l consultant	day	3	600	1800
	Travel	km	3750	0.3	1125
Data entry and analyses	SIS	day	5	25	125
	Int'l consultant	day	2	600	1200
Reporting	Int'l consultant	day	3	600	1800
Total Cost					**10590**

7.3. Action 3: product development and promotion

Task	Cost category	Unit	No. unit	Cost/unit US$	TOTAL US$
Product development	Local consultant	day	10	200	2000
	Int'l consultant	day	10	600	6000
	SIS	day	10	25	250
trailor development	local consultant	day	5	200	1000
	SIS	day	10	25	250
	promotion trailer	no.	1	2500	4000
development promotion material	local consultant	day	10	200	2000
	Local NGO	day	10	100	1000
	SIS	day	10	25	250
	Promotional material				20000
Implementation of PR campaign	local consultant	day	20	200	4000
	Local NGO	day	20	100	2000
	PV Supplier	day	20	100	2000
	SIS	day	20	25	500
	SEB	day	20	100	2000
	transport	km	10000	0.3	3000
Total Cost					**50250**

7.4. Action 4: Delivery modes

Description	Loan Amount US$
Working capital Solar International	50000
Finance credit scheme	200000
Finance battery facility	5000
Total Finance Required	**255000**

7.5. Action 5: Infrastructure

Task	Cost category	Unit	No. unit	Cost/unit US$	TOTAL US$
service outlet	structure	no.	1	7000	7000
	inventory				3000
	bicycles	no.	3	125	375
training technicians	PV Supplier	day	10	150	1500
training sales staff	local consultant	day	5	200	1000
Total Cost					**12875**

7.6. Action 6: SEB awareness program

Task	Cost category	Unit	No. unit	Cost/unit US$	TOTAL US$
Ttraining workshops SEB	Int'l consultant	day	20	600	12000
	PV Supplier	no.	15	300	4500
PV purchase scheme	SHS subsidy	no.	250	300	75000
Total Cost					**91500**

7.7. Action 7: co-ordination, monitoring and evaluation

Task	Cost category	Unit	No. unit	Cost/unit US$	TOTAL US$
Coordination	Int'l consultant	day	100	600	60000
Monitoring	local NGO	day	100	100	10000
	Int'l consultant	day	20	600	12000
Evaluation	local NGO	day	20	100	2000
	Int'l consultant	day	30	600	18000
Total Cost					**102000**

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