ESMAP PROJECT DOCUMENT

I. Basic Information

Region: South Asia Country: Bangladesh

Theme: Renewable Energy, Gender and Poverty Duration: 18 months

Title of Project Activity: **Opportunity for Women in Renewable Energy Technology (RET) Utilization in Bangladesh (Phase 2)** Revised: 1 December, 2001

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II Background & Introduction

• Within the past two decades Bangladesh has developed an impressive national network of rural electricity cooperatives (PBSs) to provide grid based electricity in rural areas. However, a large part of households in rural areas will remain excluded for the next twenty years or more from the current plans. In a recent study[1] sponsored by the World Bank, it has been found that ten million rural households are presently un-electrified. The task of providing electrification service to this large number of households is overwhelming, and that can not be accomplished in the near term by the existing PBSs alone. A suitable blend of private-public joint service delivery opportunities will be needed to face the growing demand for electrification by the sparsely distributed rural households of Bangladesh. The study revealed that a significant part of these rural households are able to utilize off-grid electrification services, until the national grid can reach them. There is a need and willingness to pay for decentralized, alternative power among rural population, which demands serious consideration.

• A key item of interest is poverty alleviation through empowerment and income generation of women within the scope of energy sector. ESMAP initiated a project entitled "Opportunity for women in RET utilization in Bangladesh" in October 1999[2]. The project has facilitated establishment of a 35 member women's enterprise called "Off-shore Electrification and Women's Development Co-operative" in a coastal island of Bangladesh, for providing energy services to the rural population. The micro-enterprise is actively pursuing off-grid electrification service by assembling DC lamps, selling lamps and battery in 6 islands of Golachipa thana of Patuakhali district and operating a business of battery charging and diesel microgrid in 4 markets. The activities of this project are increasing opportunities for women in off-farm employment with higher income and towards a skilled labor force in a technology oriented environment. It has removed the major barriers caused by the lack of scope and access to technology, information and training.

Economic impact: Opportunity for women in participating in skilled activities leading towards economic development has direct impact on poverty alleviation. Members of the women's cooperative active in other income generating activities are found to gain from their affiliation with the micro-enterprise. Their marketing skills have opened new source of income in addition to the remuneration obtained from DC lamp manufacturing. In general, women are not remunerated for their household services and hence they do not play any significant role in the financial decision making. It is found that engaging in the

[1] Market assessment survey of solar PV applications in Bangladesh by Prokaushali Sangsad Ltd., World Bank Report, July 1998.
[2] Opportunity for women in RET utilization in Bangladesh, Phase I Final report, June 2001.

micro enterprise has created the opportunity for women to earn for themselves and therefore engage in financial matters associated with family expenditure. With the rise in family income, overall expenditure pattern is expected to change with possible reduction in illiteracy for the children (who generally contribute to the family income) of the participating women.

Social impact: The gender aspect of this project has focussed on removing some of the social and cultural discrimination associated with the gender role to be played by women. This has already been achieved through the introduction of a modern and technically skilled labor among rural women through the micro-enterprise. Gender division of labor has been broken and their roles are becoming more participatory and challenging in nature. Women are now managing and keeping accounts of the business operations and engaging men employees as necessary.

- **Key lessons learnt from Phase 1 of this project include:**

1. Women's DC Lamp Micro-enterprise has developed the basic framework and modalities for off-grid electrification service. The project has created a niche in which the private sector can make a significant contribution to rural electrification even before linkage with the national grid. This is the first model of its kind in Bangladesh.

2. Scope of income generation for rural women in energy service delivery has been identified.

3. The project has identified a low-cost solution for improving the quality of indoor lighting, which also reduces pollution and health hazards for rural households, by replacing the traditional kerosene lamps by modern electric lamps.

4. A blend of private-public joint service delivery modes needs to be developed to expand access to electricity by harnessing the potential for non-conventional energy in many rural areas until the national grid system reaches them. The unmet demand can be successfully met with alternative technologies for off-grid electrification such as renewable energy and service delivery through community participation.

5. Community driven development activities, pursuing poverty reduction and gender equity by targeting the rural poor and disseminating technologies can enhance the quality of live for the rural people.

6. By shifting away from the traditional unskilled farm labor to skilled off-farm labor-creating employment in rural energy services, the project has elevated the knowledge base of rural women and developed new opportunities for their empowerment.

7. Micro-credit is an essential vehicle for enhancement of off-grid electrification for rural homes.

Proposed Activities of Phase 2 :

The Phase 2 of the project is aimed at consolidating the activities initiated in Phase 1 so that the women's enterprise can continue on its own without further assistance. The

additional thrust on market development and expansion in the scale of its activities will increase business and result in sustainable operation of the enterprise.

Technical Assistance

Prokaushali Sangsad Ltd. (PSL) will be responsible for overall implementation of the project. During Phase 1, PSL organised the women to form a cooperative for assembly of DC lamps and providing energy service to the population in the project area. They were given all the technical, marketing and management training necessary for running the business in a small scale.

During Phase 2 this technical assistance will be expanded to include further technical skills for assembly of controllers and enhancing their capability to compete in the national Renewable Energy Projects. Planning and implementation of awareness and information dissemination with market expansion in the extended area will also be undertaken during this phase.

1. Income Generation for Women in RET

(a) SHS delivery mechanism: It is proposed that the off-grid electrification service be extended to:

(i) Offer solar electrification service to 200 households in Char Montaz

(ii) Extend production facility to initially assemble 500 controllers for SHS

(iii) Participate in the national solar electrification project with efficient DC lamps and high quality controllers.

(iv) Construction of a permanent factory premise for the micro-enterprise.

(b) Micro-credit operation with revolving fund: It is proposed that a micro-credit revolving fund will be operated by the micro-enterprise for sale of 1000 batteries and hire purchase of 200 solar modules with controllers to the households.

(c)Market enhancement for utilization of DC lights in off-grid electrification:

Market development for usage of DC-lamp as a low cost lighting solution will be consolidated and extended further into 2000 households within 5 districts of Barisal division with estimated 778,000 unelectrified households.

2. Network of professional women in RET:

The in-country network of professional women organised during Phase 1 will be strengthened to promote awareness among the decision makers through suitable advocacy This will also have long term impact on incorporation of RET on economic and social development programs.

3. Institutional capacity enhancement for the Public Sector:

Capacity building of the public sector will be initiated through:

(a) Distribution of final guideline on incorporation of RET to the policy planners.

(b) Investigation of the scope of solar PV vaccine refrigeration in health centres under the Ministry of Health.

(c) A One-Day national seminar on “Role of Women in RET for Poverty Alleviation”.

In summary the proposed project aims at empowering women with the opportunity to gain access in technology driven energy efficiency programs. The proposed project will achieve the following:

1. Capacity building for income generation among rural women: *generate income by (a)efficient production and use of RET by micro-enterprise, (b) managing micro-credit for RET (c) promoting utilization of DC lamps in extended un-electrified areas.*

2. Capacity building among professional women*: Facilitate the network of professional women in disseminating RET and energy efficiency.*

3. Institutional capacity building: *Enhance capacity within the government sector for incorporating efficient use of RET in future development projects*

In the long term the project will positively impact the widespread use of efficient lighting by the rural population, initiating private investment in off-grid electrification. Women will receive direct benefit from the income opportunities created in this project. By increasing the knowledge base on environmentally sound renewable energy technologies, local, regional and global environmental benefit will be achieved.

III Scope of Work

1. Income Generation for Women in RET

In Phase I members of the newly formed women's micro-enterprise have successfully adopted the charge of providing energy service to the rural community in the southern coast of Bangladesh. Their success can be measured by:
(a) technical and managerial skill acquired for production of efficient DC lamps for household lighting,
(b) development of marketing and sales network within 6 adjacent islands,
(c) energy service delivery opportunity created by Battery Charging Stations,
(d) micro-grid service to the local market and adjacent households.

The success of the project of rural women in energy service delivery will be further enhanced in Phase 2 through the following activities:

(a) SHS delivery mechanism:

- **Household electrification:** The off-grid electrification service within Char Montaz island of Golachipa Thana will be extended for solar electrification of 200 dispersed un-electrified households on the basis of their willingness and ability to pay.

- **Controller assembly:** The DC lamp production facility will be extended to assemble high quality controllers for solar home systems.

- **Extended market for business scale up:** The micro-enterprise shall scale up and participate in the national solar electrification project as a supplier of efficient DC lamps and high quality controllers.

The micro-enterprise will engage in household electrification using Solar Home Systems (SHS). It is envisioned that the consumers will (a) purchase DC lamps by cash, (b) purchase battery with micro-credit from micro-enterprise, and (c) the women's micro-enterprise will sell solar modules with controllers to the households on a hire purchase basis.
The consultants will provide technical training to relevant employees of the women's

enterprise entrusted with installation and maintenance of the SHSs. The users will also receive necessary technical assistance from the micro-enterprise during installation. In addition, local entrepreneurs will also be trained and authorized to provide the battery maintenance service to the households, as per request and payment from the users.

The consultants will provide technical training to the members of the micro enterprise for manufacturing controllers for the SHS. These controllers will be sold by the micro-enterprise with SHS, and separately to the outside market on a cash basis. Scaling up of business for the micro-enterprise will allow it to reach the extended market as described in the accompanying Business Plan. Upcoming national solar electrification program shall also be a target market for the micro-enterprise.

Significant technical support from the consultants will be needed for import and local procurement of manufacturing equipment and hardware components. In addition, assistance will be provided for preparing Business plans for procurement of loans from various funding sources. The consultants shall also assist in preparing legal documents for going into loan/lease contracts between the SHS consumers and the micro enterprise.

(b) Micro-credit operation with revolving fund:

It is proposed that micro-credit revolving fund will be operated by the micro-enterprise for sale of 1000 batteries and hire purchase of 200 solar modules with controllers to the households. Households meeting the criteria of the cooperative will receive micro-credit for purchasing energy products from the women's micro-enterprise on mutually agreed terms and conditions.

(c)Market enhancement for utilization of DC lights in off-grid electrification:

It is proposed that the market development for usage of DC-lamp as a low cost lighting solution should be consolidated and extended further into the Barisal division comprising 5 districts with 778,000 un-electrified households. There are a significant number of un-electrified households within Barisal division which can afford alternative off-grid service today.

- The potential market for using DC lamps for household lighting will be extended to 2000 households in these remote areas through advertising using the media, community meetings , local leaders, and the rural organizations.
- 3 additional Diesel battery charging stations will be operated in the un-electrified areas. Local investors will be provided technical training and assistance on battery charging operation in 3 locations in order to initiate business to serve the households in their areas and communities. Total of 400 households will be served through all the battery charging stations of the micro-enterprise per month.
- Each battery charging station will be located in a rural market with a micro grid lighting service for the rural shops. A total of 900 rural shops will receive 4 to 5 hours of lighting service from the Diesel micro-grids.
- A very significant market exists for battery rental service. To date 750 battery rental has been provided by the BCS of Char Montaz. This service will be supported by each of the new battery charging stations.

Some of the entrepreneurs of these regions have shown interest to open the sales and marketing network. These individuals foresee the business potential of the product to be manufactured by the women, and the scope of off-grid electrification. It is therefore

expected that private capital will be invested in due course of time for initiating marketing channels and energy service delivery.

Marketing goals

The marketing goals of the micro-enterprise are well documented in the Business Plan[3] of the micro-enterprise, which include:

- To implement a suitable financing mode for hire purchase or leasing of SHS to 200 households in Char Montaz
- To sell 2000 DC lamps to be used with batteries in Barisal division.
- To sell 1000 batteries with micro-credit for household lighting.
- To participate in the upcoming Solar Electrification Program supplying lamps and controllers.
- To establish 3 new Diesel battery charging stations.
- To offer micro-credit to rural households for purchasing batteries and SHS

Technical Design, and Funding Requirements for Micro-enterprise Development:

A comprehensive 7 year business plan for the micro-enterprise has been prepared by PSL (please see attachment). Here a r[evolving fund has been budgeted for 2000 lamps, 1000 battery, 500 controllers and 200 Solar panels. Strategy include cash sale of DC lamps, 6 months micro-credit for battery and 3 years Hire purchase of solar panel with controller.] Overall budget with breakup is shown in Table 1 and Table 2 of Annex A.

Technical support will be provided to the business of Micro-enterprise for proper selection of hardware and cost efficiency.

- The DC lamps are already in production by the Micro-enterprise. To satisfy the target market and part of the upcoming national SHS project market a starting capital for standard parts and components of 2000 lamps will cost $10,545.

- Diesel charging stations:
  (1) New charging stations will be built with 5 kW generators, which will remain property of the Micro-enterprise unless co-investment is favorable for business operations. Total of 3 new charging stations will be established (1 per 6 months) with Micro-grid service facilities at $3,704 each, with a total budget of $11,111.
  (2) To provide a reliable service to the potential battery users in the vicinity, a total of 3 battery charging stations will be re-furbished at the cost of $1000 each, with a total cost of $3000 as loan to the owners. Business revenue fund will be used for this purpose hence no additional fund will be required.

- Budget for Micro-credit revolving fund for 1000 batteries is $28,000.

- Controller assembly will require procurement of component parts, tools and testing hardware including 500 high quality controller kits for SHS, at a cost of $14,000

- Solar Home Systems: 200 SHS will be sold on hire purchase to the households in

[3] Business Plan for "Opportunity for Women in RET Utilization in Bangladesh – Phase II"

Char Montaz. 150 units of 20 Wp and 50 units of 40 Wp solar PV modules with frame and accessories will be procured at $31,638.

- Permanent factory premises and facilities will require about 6 months for construction at a cost of $16,000.

Source of Capital for Operation of Micro-enterprise: Today there is a shortage of funding opportunities for solar electrification service in rural homes, however the situation is expected to change in Bangladesh within the time frame of this project. The causes for this shortage is varied, but the significant ones are:

- At this early stage of development, private investments on RET service is unavailable in Bangladesh or elsewhere in the developing countries.
- Credit for RET or any off-grid energy services are not yet available commercially.
- Consumer credit for energy appliances is also not available.
- Renewable energy has high initial cost, with low maintenance cost.
- Short term financing cannot attract significant number of beneficiaries.

Distribution of cost for Micro-enterprise development is shown in Table 1 and Table 2 of Annex A. In the recent months several funding organizations have been approached for co-funding Phase 2 of the project. Co-funding of $50,000-60,000 is being sought from several sources, which include grants and discounted loans dedicated to development projects. Current status of requests for co-financing is given in Annex A of this report.

Revenue generated from the ongoing activities will also be used by the co-operative as their contribution to the project. In case co-funding is not available at inception of Phase 2, about 75% of all the activities can be accomplished on schedule. The micro-enterprise will be in a position to continue to the activities described in the Business plan. The GOB has been requested for granting a piece of land to construct a permanent factory facility. The Women's micro-enterprise within ESMAP project has already been assisted by PSL to prepare a 7 year business plan. Further support will be provided for securing funds from two potential sources of funds, which are:

- (a) Infrastructure Development Company Limited (IDCOL)
- (b) Bank for Social Investment and Commercialization (BASIC)

IDCOL in Bangladesh is an established on-lending company that will disburse IDA funds under the rural electrification project. BASIC bank is also being considered by the KfW for disbursing funds for renewable energy activities. PSL has provided information about the project KfW. Following upcoming appraisal, this fund may become available from the Ministry of Germany.

2. Network of professional women in RET: Within Phase 1, a five-day technical training program on RET utilization for solar, biomass and wind energy was offered to 33 professional women (in science and engineering) from public sector and private organizations in Dhaka on 6-10 May 2000. A network of these professional women was thereby established for dissemination of RET, and gender-energy issues. Ten selected participants also attended a study tour to the neighboring country India where existing projects on RET utilization were visited.

The in-country network of professional women organised during Phase 1 will be strengthened to promote awareness among the decision makers through suitable advocacy. This will also have long term impact on incorporation of RET on economic and social development programs.

Activities will involve collection and distribution of latest information on ideas and experiences from similar networks and RET projects around the world for use in their respective workplaces. An important aspect of this project lies in enabling professional women to take leading roles and share responsibilities in RET implementation, which include awareness building for (a) RET utilization, (b)energy efficiency, (c) gender-energy issues. Interested members of the professional women's network will be taken to Char Montaz to observe the activities of the Women's cooperative and get exposure to the rural needs and RET project implementation.

3. Institutional capacity enhancement for the Public Sector:

It is proposed that capacity building of the public sector will be initiated through incorporation of RET policy guidelines in the policy planning. The target group of this activity are the planning cells within the sector ministries of the GOB, who were identified in Phase 1 of the project. Some of these officials from the various government ministries attended a seminar held on 18 November 2000, to whom a draft guideline for incorporating RET in Government projects was introduced. Technical information related to utilization of RET will be provided to these key players, who may incorporate RET in their future development projects.

- The existing draft guideline will be finalized and given to the Planning Commission of Bangladesh, for inclusion in the sixth Five Year Plan of the country, where resources would be allocated for future projects involving RET.
- As a special initiative under this project, a study will be conducted by PSL with the participation of qualified members of the of the women's network to investigate the scope of solar PV vaccine refrigeration in health centres under the Ministry of Health.
- A One Day national seminar will be arranged on "Role of Women in RET for Poverty Alleviation".

IV. Sustainability & Risks : According to a recent survey done by the World Bank, a vast market for solar home systems exist in Bangladesh. DC lamps are components of these solar home systems. The price of a lamp-battery system or a SHS can be reduced considerably if efficient lamps are produced and sold in the local markets. Sustainability of the program will need awareness and motivation for growth and expansion of these markets, before significant interest in private investment can be expected. It is clear that Phase 2 identifies the requirements for sustainability of operations as indicated in Annex B.

Renewable energy, especially household solar system is disconnected from the centralized system, therefore it requires operation and maintenance at the local level. This skill is to be developed through the micro-enterprise, or at the community level. Sustainability is hence closely tied to the technical and operational performance of the micro-enterprise, or similar small and medium enterprises.

- Professional women participating in a network should be interested in gathering experience and show leadership in dissemination of information on RET for the rural sectors. Otherwise, the knowledge and experience gained from this project will not

sustain in future projects aimed at rural development. In order to mitigate this kind of risk, efforts will be made to encourage the professionals to visit and participate in the activities involving rural women.

- Part of this project will involve rural women from the grass root level. Their participation will be guided by near term economic benefit from the market. Major natural calamity like flood or cyclone during the monsoon season, or other unforeseen disturbance may hinder the project completion schedule and thereby affect its outcome. Political and social unrest can equally damage the outcome and impact of the project.

V. Implementation Arrangement and Schedule

- Bangladesh SASES team will be responsible for overall management, quality, and reporting of the project.
- Prokaushali Sangsad Ltd (PSL), the field implementers of Phase I will be responsible for field management, coordination, implementation and documentation of the project.

The Women's DC Lamp Micro-enterprise of Char Montaz is a central body in field implementation of the project. They have received training on assembly, sales and marketing of DC lamps. In addition, they have been trained to provide energy service delivery using off-grid electrification options. Indicators measuring operational performance of the Women's Micro-enterprise in Phase 1 have been presented in Annex C of this proposal. With technical assistance from PSL, all activities within Phase 2 will reach smooth operational status within the project period of 18 months. Their experience in market assessment survey[4] will be used to target the potential consumers of SHS in Char Montaz.

- Private entrepreneurs will be encouraged to invest in off-grid electrification service delivery in the un-electrified areas within the district of Barisal. Their investment in sale of DC lamps and in battery charging station operation will encourage households in the local area to spend their resources in battery and lamps for lighting.

- The Rural Electrification Board (REB) operating through member owned co-operatives called the PBSs will also be encouraged to use the products manufactured by the micro-enterprise.

The exit strategy:

Exit of the project developers from the project activities is expected to be a gradual process coupled to the capacity buildup of the Micro-enterprise and the private entrepreneurs. It is expected that implementation of Phase 2 in 18 months will assist in reaching operational sustainability , and consolidate activities initiated in Phase 1. Since the national solar electrification program is now under preparation, it is envisioned that scope of participation of the Micro-enterprise and the local private entrepreneurs will rise.

Schedule for Completion: The original project was scheduled to begin in February of 2001 and reach its completion by February 2002. The revised schedule is from January

2002 to June 2003. (Please see the attached Project Implementation Plan).

VI. Team Composition

Task Leader : Nilufar Ahmad, Senior Social Scientist, World Bank Office Dhaka
Peer Reviewers : (a) Douglas Barnes, SASEG, World Bank, Washington DC
(b) Prof. Nurul Islam, Institute of Appropriate Technology, Bangladesh University of Engineering and Technology.
Field Management: Prokaushali Sangsad Ltd.
Project Manager- Asma J. Huque, Director,
Will be responsible for overall management and implementation of the project, maintaining liaison with the participating organizations. She has a Masters degree in Engineering and 17 years of experience in Bangladesh and abroad. She is a senior director of PSL and has staff experience with in UNDP, ILO and WHO. She has recently conducted the market assessment survey analysis for solar PV applications in Bangladesh and supervised solar system installations for lighting, water pumping. Recently she was also a team leader in for the feasibility study for SHS for the World Bank. Most recently she executed the project entitled 'Opportunity for women in RET utilization in Bangladesh Phase I' funded by ESMAP.
Project Coordinator- Hasna J. Khan, Director, Prokaushali Sangsad Ltd. (PSL)
Will be responsible for coordinating the overall project, external communications, reporting and documentation preparation. She is an expatriate with a PhD in Nuclear Engineering from the USA and 15 years experience with academia, research and the private sector. She recently documented the feasibility study for SHS project in Bangladesh, as an assistance toward off-grid electrification, and initiated the project entitled 'Opportunity for women in RET utilization in Bangladesh, Phase I' funded by ESMAP.
RET Specialist- M. A. Mannan, Specialist on renewable energy. Prokaushali Sangsad Ltd.
Will oversee guidelines and policy interpretation for RET utilization, its documentation and reporting. Dr.Mannan holds a PhD degree in Nuclear Engineering from the USA, and is actively pursuing renewable energy in Bangladesh, including conducting technical training programs on renewable energy.
Senior Technical Manager- Tauheed Ahmed Talukdar- Experienced in electronics research and development in Kuwait for 15 years. He holds a bachelors degree in electronics engineering and will supervise the field training programs. Mr. Ahmed played the key role of technical training and education of the women of the Micro-enterprise in the project entitled 'Opportunity for women in RET utilization in Bangladesh, Phase I' funded by ESMAP. He will continue to manage the ongoing activities for field training program and its execution as per implementation plan of this project.
Other Staff - Experienced research associates and technical staff of PSL will be involved in technology demonstration, training, market and business development of SHS in the field. Office support staff will be involved in document compilation and other services.

PROJECT DESIGN SUMMARY

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
1. **ESMAP Strategy-related Goal** Environmentally sound renewable energy technology (RET) utilization in rural electrification for poverty alleviation.	Renewable energy policy of the Government in support of rapid expansion of RET. Role of community based organizations and private sector in	Country energy policy paper Sixth five year plan for resource allocation	RET project and policy development with effective participation of Women is essential for sustainability.

	participation for decentralized power generation.		
2. **Project Development Objective** A local capacity and network with rural women of micro-enterprise, private entrepreneurs, local NGOs, PBSs, for off-grid electrification in economic development and poverty alleviation.	• Women's Micro-enterprise, private orgnizations, and NGOs are participating in national SHS program	• Ongoing project reports on project implementation with feedback from beneficiaries	• Rural electrification is beneficial to the livelihood of rural household • Rural women can act as effective energy service providers.
3. **Expected Outputs** (a) SHS utilization in the project area of Char Montaz (b) Rural households using DC lamps with batteries for lighting and electrification in the extended impact area (c) Capacity of local Micro-enterprise in managing micro credit for purchase of batteries and energy hardware in support of off-grid electrification.	• Number of households using SHS from the micro-enterprise • Number of households using lamp-battery system • Number of people using micro –credit from to purchase energy hardware for lighting	• Micro-enterprise database for energy service delivery • Sales report of DC lamps through the retailers • 5 Quarterly report and 1 Final report of achievements of Micro-enterprise	• It is cost effective for the rural household to use SHS for electrification. • Income generation is sustainable for the beneficiaries • Service from DC lamps is satisfactory and available at remote locations. • Energy credit for the rural households can remove the first cost barrier of adopting RET
2. Capacity of professional women from public and private sector to participate in a network.	• Number of awareness buildup programs undertaken by the network	• Appropriate sections of project reports	• Professional women are interested in actively pursuing awareness of RET utilization
3. In-country capacity of the Government officials for developing projects with effective utilization of RET in developmental projects	• A guideline for developmental projects adopting RET • Number of projects using the guideline.	• Government Agency Reports.	• Renewable energy Policy of the government.
4. **Project Tasks/ Components:** 1. **Income Generation for Women in RET:**			Consumers will

(a) Household Electrification using Solar Home System • The women's micro-enterprise will sell on hire purchase or lease solar modules to the households • Controller manufacturing facility • Local entrepreneurs will be trained and authorized to do wiring, provide the battery maintenance service to the households	Input: 30,000	**-200** Households using SHS service delivery **-35** Women trained to assemble SHS controller **-500** controllers manufactured -Extended market for national SHS project: 500 lamps 250 controllers sold per month **5** technicians trained in wiring and maintenance of SHS	(a)purchase DC lamps by cash, (b)purchase battery with micro-credit (3) solar module and controller on hire purchase Technology and hardware for controller manufacturing will be available. Reliable source of electronic components will be available. Sufficient business potential is evident for maintenance of SHS.
(b) Micro-credit operation: • The women's cooperative will provide microcredit to users of its services to procure related products at designated interest rates and tenor	Input: 30,000	**1000** batteries, **200** Solar modules **200** controllers sold on micro-credit	Women are already engaged in mirco-credit activities for energy products. It is assumed that SHS will be affordable to rural households using micro-credit.
(d) Enhancement of potential market for using DC lamps for household lighting • Awareness of DC lamp usage as an offgrid solution will be extended to the remote areas of Barisal division • Local investors will receive technical training and assistance		**2000** additional households using DC lamp **3** New battery charging stations installed **400** households using battery charging station	A market of decentralized DC lamps and batteries is already in the process of development for sufficient sales and sustainable business. Large demand for reliable battery charging. Proper logistic support for training are available in the rural

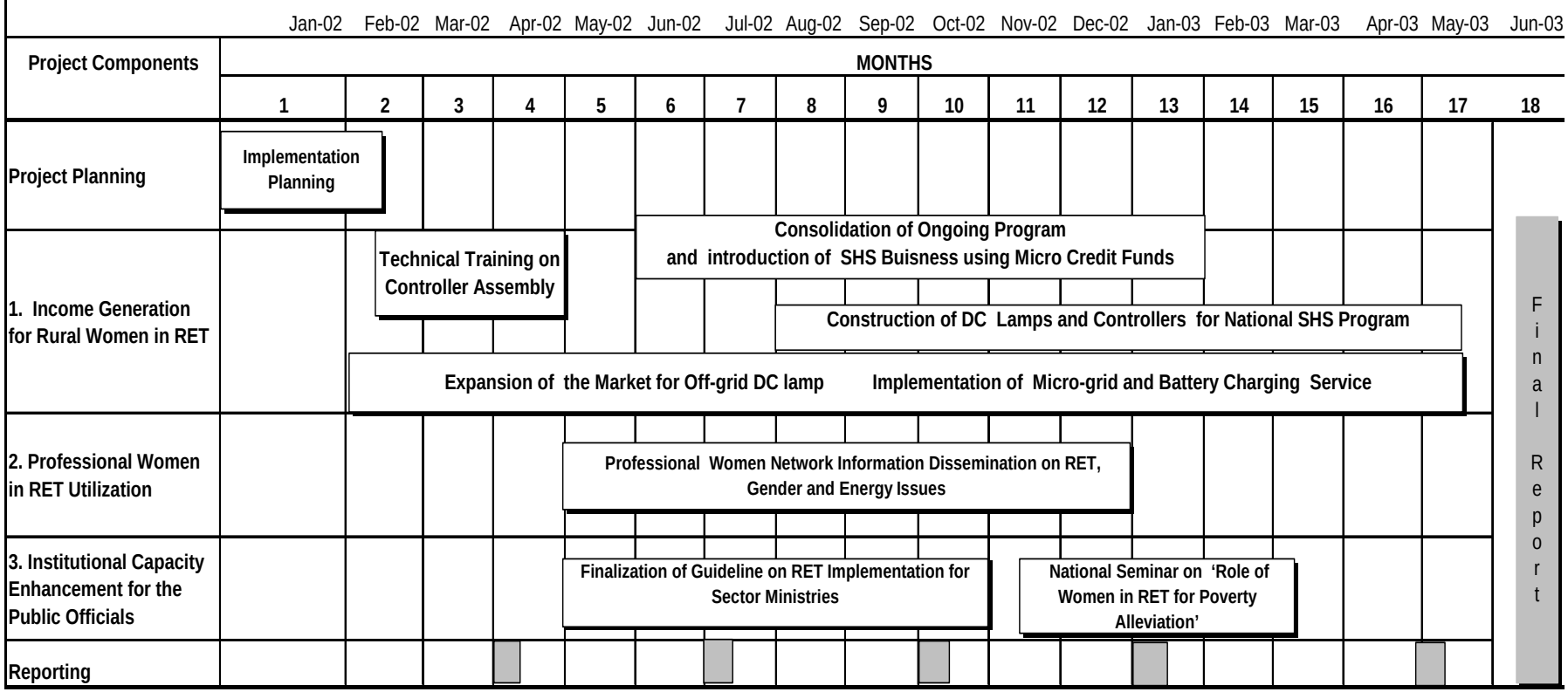
on battery charging operation in order to initiate business **2. Professional women in RET Utilization:** • Existing network of professional women will participate in RET dissemination for rural development 3. **Institutional Capacity Enhancement of the Public Sector:** project designers and decision makers of planning cells the government ministries will receive information on RET usage.	Input: 10,000 Input: 15,000	**900** rural shop owners using Micro-grid service 33 professional women participating in information dissemination **RET Guideline** made available to the Government ministries. A study conducted to investigate the scope of RET utilization in the Health sector. **One-day national seminar** on "Role of Women in RET for Poverty Alleviation"	area for the project period. Existing network of professional women are interested in rural economy and social development It is assumed that the Government agency representatives will benefit from using the guideline on RET utilization. Extension of the cold chain for vaccine refrigeration can prevent its expiration

Abbreviations:

GOB	Government of Bangladesh	PBS	Palli Biddut Samity
ESMAP	Energy Sector Management Assistance Program	NGO	Non Government Organization

Opportunity for Women in Renewable Energy Technology (RET) Utilization in Bangladesh Phase II

PROJECT IMPLEMENTATION PLAN



Annex A

Table 1. Micro-enterprise Development Fund Distribution

Annex B Sustainability

1.1 Role of Micro-credit in Off-grid Market Growth

There is a significant role of Micro-credit for the off-grid rural electrification infrastructure of Bangladesh. These operations can be accomplished by several operators, including: (a) Local NGOs, (b) Rural banks, (c)Co-operatives, or even the (d) PBSs. Rapid growth of the off-grid electrification market will depend on availability of consumer credit from NGOs or any other source, for procuring lamps and batteries by the un-electrified rural households. Recent experience from Char Montaz shows a lack of interest of the local NGOs in taking risks for diverting their income generating funds for energy credit. However, the women's co-op offered micro-credit for battery sale at their own risk, and succeeded with 98% recovery in sale of 300 batteries.

The women's Micro-enterprise is aiming at attracting seed funds for establishing the institutional mechanism for micro-credit operation to managing consumer credit for batteries. Dissemination of 'energy credit' to the potential beneficiaries is envisioned by this project. Sustainable expansion of DC lamp market will depend on the availability of requested funds being disbursed efficiently.
Currently most private financial institutions and commercial banks are designed to serve the venture capital of higher income groups, which is clearly a limitation and outside the consideration of small enterprises like the rural co-operative. Although designed to operate as a co-operative, the institutional is based on profit making and commercial operations. Hence the institutional form is not a primary deterrent for accessing the funds. On the contrary, low return on equity is the barrier, which is inherent to the challenge of serving the rural population with limited expendable income. In addition, foreign currency exchange risk also poses additional barriers to these operations. Such features of the RET market should therefore be understood.

1.2 Risk of Operation:

In this project, the aim was to demonstrate the acceleration of off-grid electrification through innovative methods, which is the capacity building of rural women in energy service delivery. In the absence of the necessary infrastructure, the project has built up the framework for operation, which is still under development. The risks for the operation are embedded in the following:

1. Mismatch of tariff with household income.
2. Unavailability of good quality batteries.
3. Unavailability of credit for purchase of batteries and lamps.
4. Unavailability of good battery charging service in the area.
5. Inconvenience of transport of batteries to the charging stations

In order to grow into a sustainable operation, the Micro-enterprise is trying to remove some of the barriers stated above. However, success can only be measured given the time required for the technology to establish itself among the rural people.

Annex C

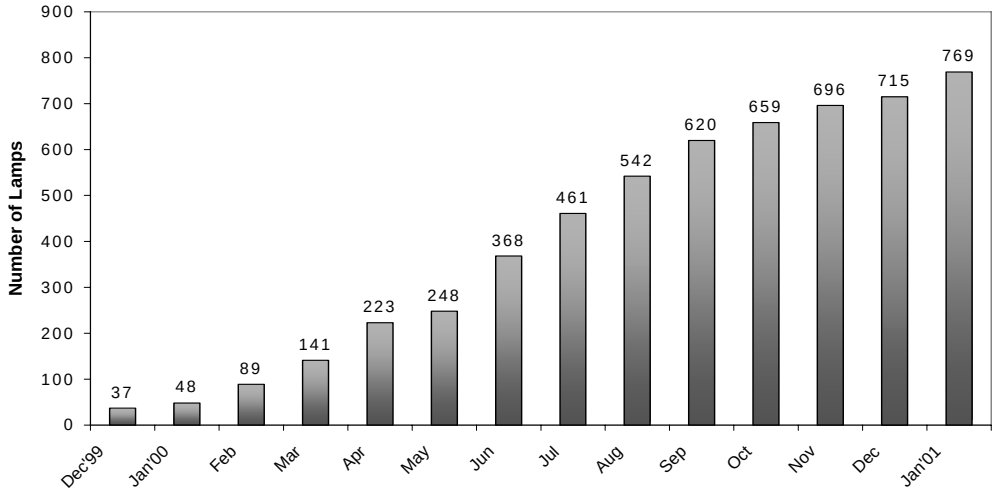
Indicators Measuring Performance of Micro-enterprise

Selected outcome indicators used to measure the performance of the Women's Micro-enterprise has been presented here. These are abstracts from the final report under review by ESMAP.

1.1 Sales of DC Lamps:

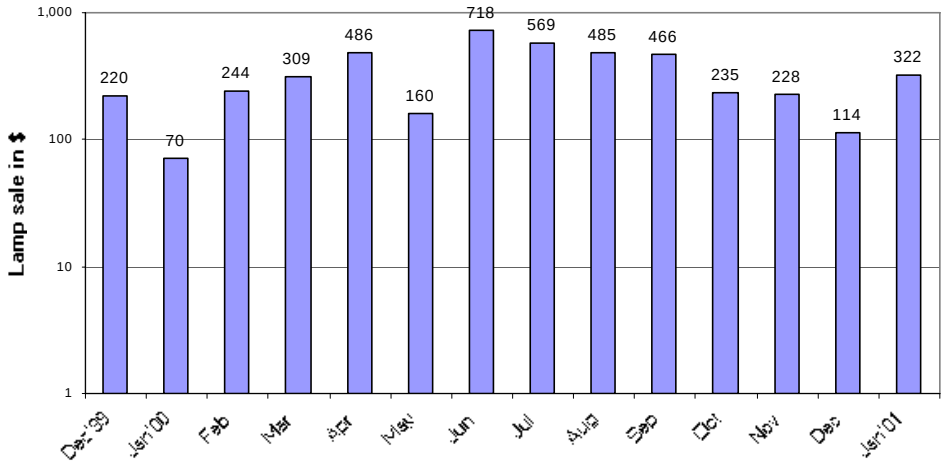
Manufactured lamps are sold through various selling media, which include the outlet center of the Micro-enterprise in Char Montaz, direct sale by the members, marketing agents and retailers in the different islands. Cumulative number of lamps sold by the Micro-enterprise from all sales centers is shown in Figure 1.1.

Figure 1.1 Cumulative Number of Lamps Sold by Micro-enterprise



In the absence of convenient transport and communication, the marketing missions aim to optimize the time and resource spent. Collection of funds from the retailers located in the different islands have a time lag, hence sales per month is not uniformly distributed over the periods. Monthly sales of DC Lamps in is shown in Figure 1.2

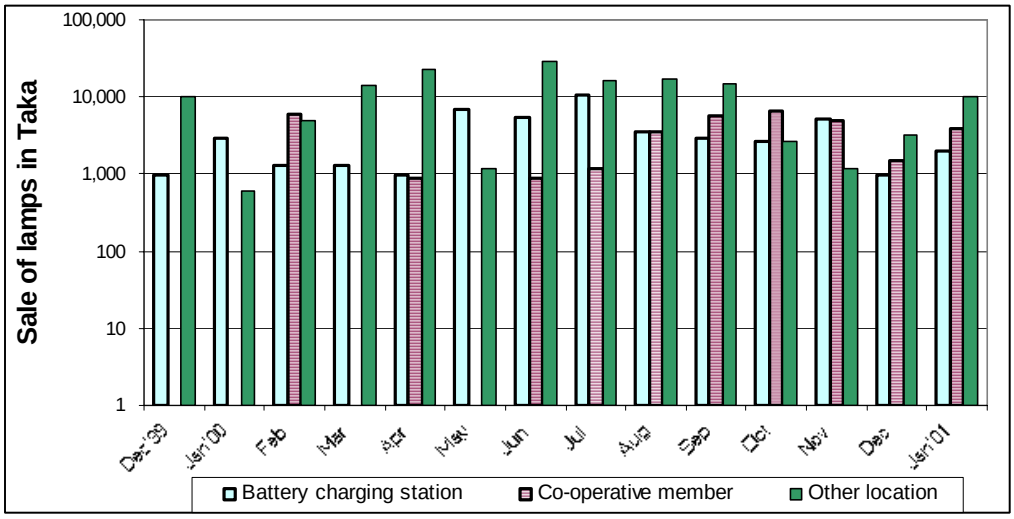
Figure 1.2 Monthly Sale of DC Lamps by Women's Micro-enterprise



1.2 Performance of DC Lamp Sales Network:

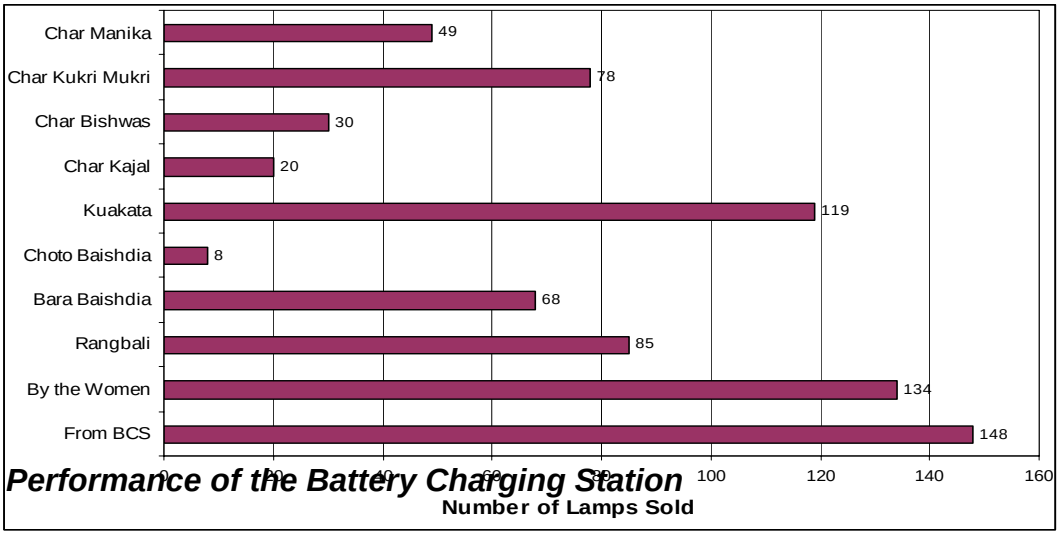
Within Char Montaz there are two main avenues for sale, i.e. (a) from the central battery charging station, which is the major outlet center, and (b) direct sale by the women participants of the Micro-enterprise. There are in total 17 retailers selling DC lamps in locations within the different islands. Cumulative sale of lamps from the private retailers located in the different islands have exceeded the sale volume in Char Montaz as shown in Figure 1.3.

Figure 1.3 Monthly Sales Distribution of DC Lamps in Various Locations



Sale from the different retail centers vary largely as shown in Figure 1.4. This is an indicator of the consumer distribution and marketing success in the various locations. However, the capacity of lamp assembly of the Micro-enterprise is much higher than the rate of sale, therefore, there is a greater need to enhance the market by extending it to other locations beyond Golachipa Thana. In future more emphasis will be given to create regional sales centers where sales volume is high.

Figure 1.4 Sale of DC Lamps from Various Sales Centers

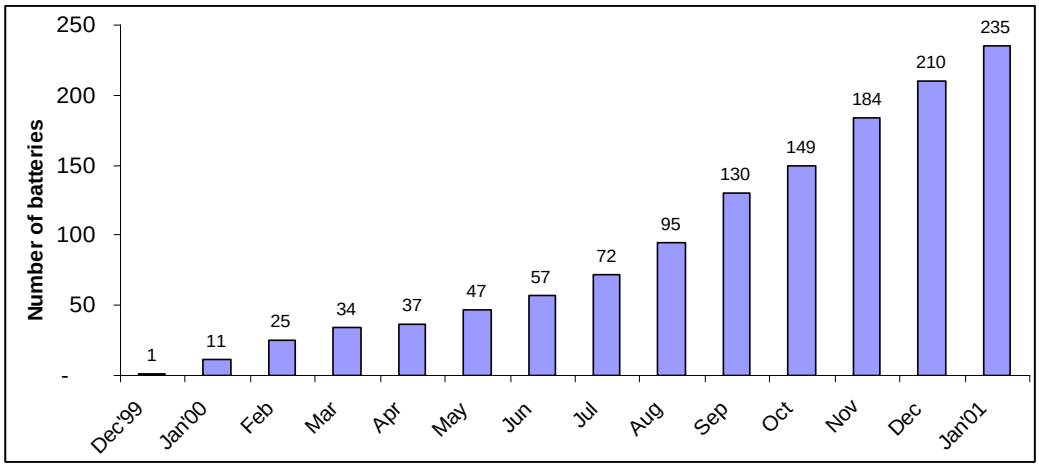


Performance of the Battery Charging Station

2.1 Sales of Batteries:

Batteries of different sizes and voltage are mainly being sold from the battery charging station (BCS) and women marketing agents. Few are also sold from the other sales centers, on behalf of the Women's Micro-enterprise. Figure 2.1 show the cumulative sales of batteries by the women's Micro-enterprise.

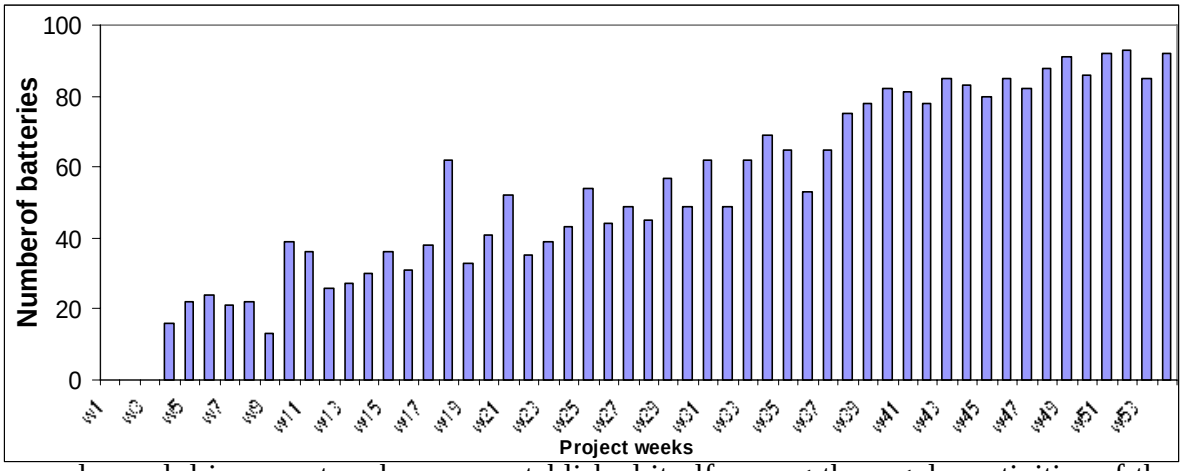
Figure 2.1 Cumulative number of Batteries Sold by Women's Micro-enterprise



2.2 Battery Charging Service:

Use of DC Lamps assembled and sold by the Women's Micro-enterprise for household lighting, is strongly dependent on the availability of a reliable BCS. This is the first BCS in Char Montaz that came into operation with implementation of the project. Figure 2.2 shows the number of batteries charged by the BCS per week. As shown in the figure, the number has slowly increased over time indicating a positive market growth. The clients for the BCS include (a) owners of batteries purchased from the Micro-enterprise, (b) battery users from nearby islands and (c) battery from the boat owners.

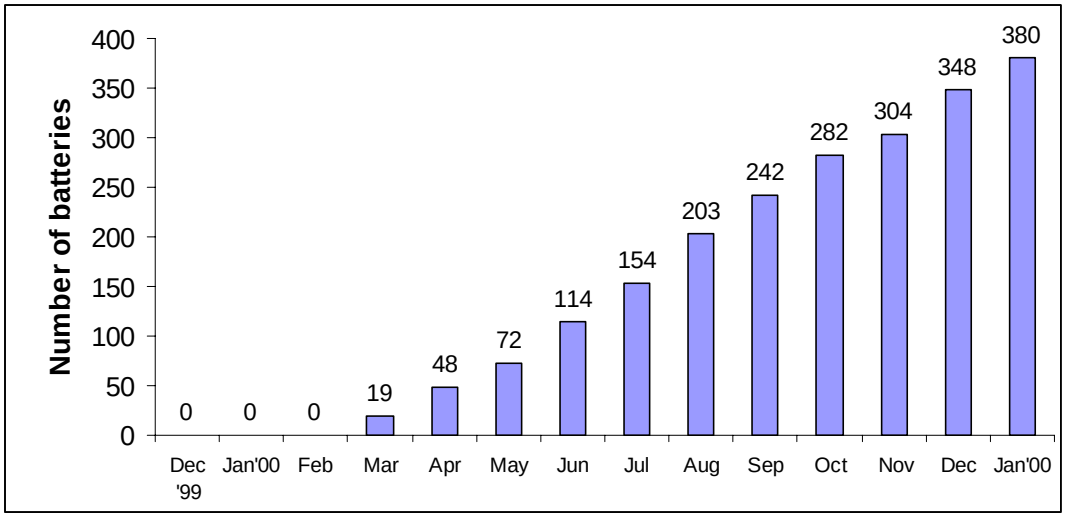
Figure 2.2 Number of Batteries Charged per Week by the BCS



demand driven venture has now established itself among the regular activities of the

BCS. Figure 2.3 shows the cumulative number of batteries leased by the Micro-enterprise since the leasing activities commenced in March of 2000, i.e. two months after the operation of BCS. *This reveals the occasional, yet high, demand for energy in meeting the needs of the rural sector. These systems are highly valued for emergency needs, community meetings and social functions.*

Figure 2.3 Cumulative Number of Battery Leased from the BCS



2.4 BCS User Survey:

The batteries, which are charged at the battery charging station (BCS), are used for different purposes such as, DC Lamps, operation of Radio and TV. A survey of the battery users was performed from the BCS, i.e. the sample constitutes of consumers of the BCS. From the survey of consumers of BCS it has been found that 54% of households use batteries for operating radios, 37% for DC Lamps and 9% for TV. It is found that majority of the users charge their 8V batteries for listening to the radio. According to the survey, 12V batteries are used mainly by the TV owners, and also for lighting. These users are prepared to adopt SHS, and expressed their preference.