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GLOBAL ENVIRONMENT FACILITY (GEF)**

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**RENEWABLE ENERGY-BASED ELECTRICITY FOR RURAL
SOCIAL AND ECONOMIC DEVELOPMENT (RESPRO)**

GHA/96/G31

REPORT OF THE FINAL EVALUATION

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FOREWORD

This report presents the main findings, conclusions and recommendations of the final evaluation mission related to the UNDP/GEF/ GHA/96/G31 project entitled : **“Renewable Energy-Based Electricity for Rural Social and Economic Development”** (RESPRO).

The evaluation is being undertaken in order to assess and document the experience to date with the design, implementation, impact and potential for success of the RESPRO project and to suggest improvements that can be made to the project.

This report covers the whole items included in the terms of reference of the mission (Annex I). Along with the evaluation of all project outcomes and activities, this document also presents the main findings and recommendations directed to the project, as well as to the Government of Ghana in order to sustain the processes that have been launched through the RESPRO project.

The field mission of this final evaluation took place from 21 to 27 October 2002, and involved three independent consultants, Dr Samir Amous (International Consultant-Team Leader), Prof. Johnson ASIEGBU (International Consultant), and Mr Amadu Mahama (National Consultant).

The mission had the opportunity to :

- Meet with the major stakeholders involved in the project and in the decision making process related to the Energy sector in Ghana; (National Agencies, UNDP, NGOs, Private sector representatives, etc.);
- Undertake a field visit to the RESPRO offices, as well as to the major areas and sites targeted by RESPRO.

The mission members do express their thanks to the Ghanaian Authorities, including the RESPRO representatives, as well as to the UNDP-Ghana Office, for their full support and availability to ensure success of this Final Evaluation.

The mission members would also like to express their full thanks to the Ghanaian people, at the grassroots level of the targeted beneficiaries, for their kindness, availability, and full cooperation, in providing the necessary and relevant information to the Evaluation Team, in such a way that they could better understand the project outcomes and performance, and their main concerns and expectations in relation with the fulfilment of their basic electricity needs.

1. MAJOR FINDINGS, LESSONS AND RECOMMENDATIONS OF THE EVALUATION MISSION

1.1. The RESPRO project has been implemented as a means to address the need to find sustainable energy paths for rural social and economic development, while at the same time minimizing the disruption to the local, regional or global environment and maximizing the economic benefits. It has consisted on the development of a PV dissemination process in the Northern regions of Ghana as an alternative to the expansion of the fossil fuel-based rural electrification.

1.2. Though the project has resulted in insignificant amount of carbon reduction,¹ due to the limited number of PV systems disseminated, the RESPRO has remarkably succeeded in the achievement of its development objective. Moreover, by offering new perspectives for the development of carbon-free electricity generation technologies in Ghana, the RESPRO project has demonstrated:

- The social and economic benefits, as well as other important positive side-effects; of the PV dissemination in the remote areas;
- The technical feasibility of the PV systems in Ghana;
- The economic feasibility as compared to the grid-based electricity;
- The capacity of the local population to manage the process of the market development and to ensure a full ownership of such process;

1.3. The RESPRO has also allowed to capitalize a very valuable experience on the approaches and modalities for the development of the PV market, and on the logistical, human and financial resources needed to make this technology a really reliable alternative to the grid for the rural population.

1.4. In addition, despite the short duration of the project, the RESPRO has contributed to convincing the Ghanaian Government of the relevance of such electrification alternative, and of the necessity to fully integrate the PV dissemination within its electrification strategy. The multiple follow-up initiatives, launched by Ghana, aimed at providing new resources for PV development, with possible support from Spain, USA, China, etc., and at establishing adequate institutional framework (e.g. possibly a Renewable Energy Services Trust), provide clear indications and signals of the seriousness that the Government of Ghana is willing to consider the PV technology. Hence the future appears quite bright for the PV system in Ghana after the termination of the RESPRO.

¹ No more than a few hundreds of Tons of CO₂ equivalent implied by the 1800 PV systems disseminated. However, if we consider the implications of the project, in terms of market transformation for the longer term, the emission reduction would be much more significant.

1.5. On the other hand, the results of RESPRO's experience can be made more significant, provided that the following priority recommendations are put in place, both at the project and at the Governmental level.

1.6. **Give more visibility to the project outcomes to replication of the PV dissemination experience in other remote regions:** The results of RESPRO's experience can be made more significant, first of all, by giving more visibility to the project outcomes. For instance, a video documentary on the project shown on Ghana Television could raise awareness nationally for other communities and individuals, to appreciate what solar PV can do. This can also arouse the willingness of these communities to acquire such technologies, and of the political representatives at district, community and village levels to replicate the dissemination experience of the PV systems.

1.7. **Promote increased productive uses of electricity by rural enterprises:** This is a pure extension service to build the long-term social capital in the beneficiary communities. RESPRO should take on board one of its initially envisioned roles, that is leading the way in promoting productive uses of electricity for rural transformation. How? RESPRO should aim to establish linkages between existing and potential rural enterprises with sources of credit, technology and business development support, and provide information and guidance on increasing productive uses of electricity. Through arrangements with NGOs, micro-finance institutions, and other entities, information on technology options and costs could be provided to assist and accelerate the process of rural entrepreneurs and small scale enterprises taking advantage of the business development opportunities created by solar photovoltaic.

1.8. **Provide for a better fit into the customer's requirements :** In parallel to the development of bigger systems to fit the needs of the productive commercial or small industrial entities, the RESPRO should also put a better emphasis on the development of much smaller individual systems, to fit the needs of a portion of the population that, because of their financial conditions, are only willing to acquire PV systems that fit their lighting needs only. This will allow this population to have an immediate access to the most wanted social service in the rural context.

1.9. **Bridge the expectations gap:** RESPRO should take urgent steps to bridge the yawning expectations gap between the present service level and the service level that her clients expect, and that the project was supposed to supply. One of the major gaps identified by the Evaluation Team was the omission of the implementation of Low-voltage mini grids to be managed at the community-village level. Such Hybrid systems could then be made to supply special enterprise zones to assist enterprises that require AC power, in particular those linked to the Refrigeration needs, where technical and business solutions could be explored to provide cold storage facilities or ice-making enterprise. The RESPRO is offering a unique opportunity (duly specified as activity 2.2.5 in the project document) to test the technical and financial viability of the PV Hybrid systems for electrifying the Ghanaian remote areas. This opportunity should not be lost as sufficient resources are still available to implement a few cases of life-sized Hybrid-systems.

1.10. **Reform tariff policy:** Urgent discussions should be initiated with government and the Public Utilities Regulatory Commission (PURC) on a mechanism that will enable the high cost of the PV electricity to be integrated into the national electricity tariff to ensure that the benefits of cross subsidization due to poor rural communities also reaches the clients of RESPRO. The clients feel that the present arrangement, where they are boxed into a high cost electricity market is inequitable and socially unjust. Our attention was drawn to the recent developments in the electricity tariff increases that prompted the President of Ghana to immediately intervene with a social relief for lifeline consumers to be further subsidized at a level that would not place undue stress on the budgets of the very poor. Such social reliefs are probably more important for the clients of RESPRO most of whom fall within the poorest segment of the population.

1.11. **Community Participation:** RESPRO should actively pursue the development of community-based organizations, which could represent the clients and potential clients of RESPRO in consultation with the management and staff of RESPRO. Such an approach could significantly increase goodwill in the community and even assist in improving activities like revenue collection. An Association of Users of Solar PV services has been proposed by some clients, lets go for it!

1.12. **Private sector and associative sector participation:** The RESPRO should actively test the modalities for a gradual involvement of the private sector and of the associative actors in the development of the PV market. Provided that the PV systems are fairly considered as a viable alternative option to the grid and integrated as such into the National Electrification Strategy, it will be important to grant this option a full consideration in the future, as, at a cruising speed, any centralized market development approach will experience serious bottlenecks and thus will significantly hamper the market development potential.

1.13. **Market effectively:** RESPRO needs to develop its marketing and social animation skills to be more effective and appropriate in targeting the poor rural communities, which for the time-being represent the core of the market. A mix of social marketing and commercial marketing approaches should be pursued to ensure that the products and services are packaged to meet the needs of clients better, and that the products will continue to be in demand well beyond the life of GEF funding.

1.14. **Networking:** To achieve greater impact, RESPRO will have to carry its responsibilities beyond the delivery of PV systems. RESPRO should begin to network with other development stakeholders more effectively to ensure that their efforts are combined to achieve the best synergies. Partnerships with local Government, the District Assemblies, the Regional Coordinating Councils, the NGOs, and other civil society groups on specific tasks relating to community development are one sure way to optimise the benefits of PV electrification to the community.

1.15. **Project extension** : it is the view of the Evaluation Team that consideration be given to extending the project life by 6 to 9 months, according to the budget availability, in order that important omissions in the project activities can be implemented. These outstanding activities are mainly: (i) the hybrid systems and mini-grid demonstration projects; (ii) Provision of Radio communication facilities for field operation; (iii) Provision of motor cycle or other transport provisions, to enhance the mobility and response of the technical field staff in the target areas.

1.16. The suggested extension will also give the project management the possibility to better understand the problems and lessons to be learnt in the replacement of some components of the PV systems, such as batteries, which are almost due.

1.17. No new funds will be required from GEF during the proposed extension. The activities will be funded from the available project budget US\$231,735² and accrued revenues (US\$ 120,000) from the fee-for-service collection received from clients, over the project period.

² This figure was provided by the project coordinator.

2. RELEVANCE OF THE PROJECT TO THE DEVELOPMENT PRIORITIES OF GHANA

2.1. Rural electrification is one of Ghana's success stories. Nationally, over 35% of the population has access to electricity. However, this access is unevenly distributed, and heavily skewed in favour of the urban population. The access to electricity is also not evenly distributed across the ten regions. For example, the three Northern Regions recorded below national average access to electricity as follows: Northern 16%, Upper East 13%, and Upper West 9%³.

2.2. In 1989 the Government of Ghana formulated a policy on grid extension, and made a commitment to extend the supply of electricity from the national electricity grid to cover all parts of the country by the year 2020. A National Electrification Scheme (NES) was subsequently conceived as the means for realizing this policy. Under the first phase of the project all district capitals in the country were connected to the national grid. Under the second phase of the scheme, villages were considered for connection to the grid on the basis of a well publicized, transparent, and demand driven approach referred to as Self Help Electrification Project (SHEP)⁴. Recent estimates of the achievements of the NES shows that: 1) all district capitals in the country have been connected to the national electricity grid, 2) over 2500 villages across the length and breadth of the country have also been connected under various SHEP programme phases. The NES is a clear demonstration of the commitment of the Government not only to extend the benefits of electricity equitably across all the regions of this country and thereby promote economic development, but also to support the decentralization process at the district level.

2.3. Ghana Vision 2020⁵ was launched in 1997 as the social and economic development blueprint. The Plan is focused on: 1) Reducing poverty, reducing disparities in income and opportunities among the entire population, 2) Increasing productivity in all sectors, particularly agriculture, 3) Promoting rural development by increasing public investment in economic social infrastructure in rural areas, 4) Creating the enabling environment for social and economic development by pursuing reforms in governance and legal frameworks. A recurring theme in the Vision 2020 is the need to pursue vigorously the activity of expanding the access of rural population to modern energy services, particularly electricity⁶.

2.4. On coming into office in the year 2000, the present government decided to join the HIPC debt relief initiative of the World Bank, under which, up to US\$ 200 million dollars a year could be saved in debt service payments⁷. These savings are to be utilized to reduce poverty. Government has therefore drawn up a comprehensive poverty reduction strategy

³ Ghana Poverty Reduction Strategy, 2002-2004: An Agenda for growth and Prosperity. Page 143, 145

⁴ Under SHEP, villages were pre-qualified for participating in the scheme if they met certain preconditions, which included: The village was located within 20 km of existing sub-transmission or distribution network. Procurement and planting of all LV poles required to electrify the village, and also show proof that at least 20% of the houses in the community were wired and ready to take electricity.

⁵ Ghana Vision 2020. The Medium-term development Plan, (1997-2000).

⁶ Ghana Vision 2020. The Medium-term development Plan, (1997-2000), p164-167.

⁷ 2002 Budget Statement.

document⁸, which in effect represents government's medium-term development strategy as a follow up to the Vision 2020. It is important to note, that the need for improving energy provision for production and social services still remains a central theme in the Ghana Poverty Reduction Strategy document. The strategy calls for among other things, the introduction and support for the development of renewable energy technologies, such as solar photovoltaic, with the view of ensuring that the energy supply is capable of being used for productive purposes, in rural areas and by the poor in particular to foster equitable growth and accelerate agro-industry.⁹

2.5. The Energy Policy framework in Ghana, is loud and clear on the need to “energize” the wheels of economic and social development, and the pivotal role of Renewable Energy Technologies (RET). Based on the discussions, and the responses given by officials to the many questions and issues raised by the Evaluation Team, it seems quite clear that the Ghana RESPRO Project, despite some teething problems not uncommon with such new pilot projects, may correctly be described as now a project in the front-burner of the new rural electrification policy adopted by the government of Ghana.

2.6. The Government of Ghana has shown a clear determination to develop the PV market as a credible alternative to the grid. A recent policy paper has re-stated the government's RET policy intentions as follow:¹⁰

- Create a level playing field for renewable energy by removing fiscal and market barriers;
- Encourage utility companies to adopt renewable energy in their supply mix;
- Provide government funding to support non-grid connected areas with PV services to support agricultural and social services, such as schools, clinics and potable water;
- Support technological development and cost reduction through pilot demonstration projects and local manufacture of RETs.

2.7. The RESPRO project has sought to demonstrate the viability of photovoltaic technology as a cost effective and complementary strategy to extend electricity to remote and dispersed settlements, particularly in Northern Ghana. In 1999, 39.5% and 26% of the population of Ghana were below the Upper Poverty Line (UPL) and the Lower Poverty Line (LPL) respectively; during the same period, the Northern Region where most of RESPRO's clients are located, showed that as much as 69.2% and 57.4% of the population were below the UPL and LPL respectively¹¹.

2.8. The Project is therefore, not only relevant to the development priorities of the Government, but a potential prime mover for many social services in the areas of health, education, and the development of small and medium scale enterprises, so central to the Government's poverty alleviation agenda. The project has also been very precise in targeting the poor, given the geographical location of its core clientele.

⁸ Ghana Poverty Reduction Strategy, 2002-2004: an Agenda for Growth and Prosperity.

⁹ Ghana Poverty Reduction Strategy, 2002-2004: an Agenda for Growth and Prosperity.

¹⁰ Energy for Poverty Alleviation and Economic Growth: Policy framework, Programmes and Projects. Ministry of Energy, November 2001, page 15.

¹¹ GPRS, February 2002

3. EFFECTIVENESS OF THE APPROACHES USED TO CARRY OUT THE ACTIVITIES OF THE PROJECT

3.1. After the VRA withdrawal, the most appropriate option available was to establish an independent project entity responsible for implementing the RESPRO activities. By establishing its headquarters in Tamale, and some local office-bases (Bunkpurugu, Nakpanduri, Bolgatanga), in areas of its field operations, by training its core staff¹² and around 90 locally-based technicians in PV installation skills, the RESPRO has been able to establish the appropriate logistical and organizational framework for the project implementation. Thus, it was able to install a remarkable number of PV systems, to its up-country customers, and more important, to pave the way for the development of the PV market in the remote areas of Ghana.

3.2. For higher efficiency, the acquisition of transport vehicles (like motorcycles) and the establishment, in future, of radio communication links, with and between its different office-bases in different parts of the Northern Districts, will enable RESPRO to provide PV installations as well as maintenance services, still much quicker or faster, to its growing number of rural beneficiaries.

3.3. At the centre of the delivery approach in the RESPRO project is the concept of fee-for-service. As a dissemination strategy for PV systems in rural environment, this approach is not entirely new in Ghana. A similar strategy was adopted for Kpasa PV electrification project under the sponsorship of the Ministry of Energy. To a large extent this approach was effective in the East Mamprussi District. The RESPRO project was very innovative in integrating community based structures and private sector players into the revenue collection, bill delivery and outreach programmes, thereby containing the enormous overhead costs that would have been incurred if the project had adopted the approach of employing cashiers and revenue collectors directly.

3.4. What is important to note of this delivery strategy is the customers' perception of some serious inequities in the PV tariffs compared to grid connected customers. During the time of the mission, grid connected life-line customers in Nakpanduri (the nearest grid-connected town to the project area) were paying 9,000 Cedis per month for consumption up to 50 kWh per month, while 100 Watt PV customers were required to pay 25,000 Cedis per month,¹³ for a much lower level of service. The wide discrepancy in tariffs under the PV fee-for-service system compared to the grid tariffs for rural electrification customers, does not encourage a natural growth in the customer base of PV customers in the long-run, as communities will tend to exert all the social and political pressures to receive the cheaper/heavily subsidized grid option.

¹² Around 20 persons, of whom 7 are technical graded staff (technical engineer to above).

¹³ In addition to the 500,000 Cedis required as a connection fee and 150,000 Cedis required as a first instalment fee (6 monthly-payment advance).

3.5. In some cases, inadequate power allocation due to the weak attention paid to the precision of the assessment of the PV capacity needs of the customers were also noted.

3.6. The second dissemination strategy which involved outright sale of complete systems at full cost received a much lower level of patronage than the fee-for-service option. Quite apart from the high costs involved which effectively excluded much of the rural households from choosing this option, the marketing effort in the urban centres was not vigorous enough to create the awareness for a sustained demand for PV systems either as back-up systems for grid connected customers or peri-urban residents who do not have a grid connection

4. CAPACITY AND ADEQUACY OF INSTITUTIONAL ARRANGEMENTS FOR THE EXECUTION AND IMPLEMENTATION OF THE PROJECT

4.1. The Evaluation Team found that the capacity and institutional structure of RESPRO was appropriate for implementing the project.¹⁴ The Project Steering Committee, which served as the inter-governmental, inter-sectoral group, had oversight responsibility for project implementation. The Committee was sufficiently high-powered, and experienced team who met regularly, and provided clear directions for project execution and implementation decisions.

4.2. The organizational structure was lean yet effective, as every effort was made to maximize the contribution of all team members. There is currently quite significant operational capacity, with five RESPRO offices (including Accra) having some 20 full-time staff; and some trained field technicians, some of whom were also interviewed by the evaluation team at Nakpanduri and Bunkpurugu.

4.3. The Project Staff under the leadership of the National Project Coordinator were technically qualified and comprised highly motivated individuals. The National Project Coordinator is a professional Engineer of many years standing, with experience in utility management and rural electrification. The administrative and support staff consisting of the Accountant, Secretary, and Drivers, complete appropriately the organisational structure of the project.

4.4. The level of proficiency of the project-employed Engineers and Technicians is extremely high. The two Engineers have professional qualifications at the University level, with additional training in solar technology both locally and overseas.

4.5. The technicians are fully qualified (Full Technology Certificate) and received additional training in solar technology at the Kwame Nkrumah University of Science and Technology in Kumasi.

4.6. In addition to the Project Office in Tamale, RESPRO has established four additional field offices at Bunkpurugu, Nakpanduri, Binde, and Navrongo. This arrangement we believe is critical and the minimum necessary for the delivery of efficient PV services to rural clients. Communication between the field offices and the Tamale project office is by radio telephone.

¹⁴ See the Project organisational structure in Annex 4.

4.7. The field technicians located and operating in different parts of the targeted districts, were able to respond to most of the needs of the PV customers. The linkages with the local private sector (village level electricians) proved effective in dealing expeditiously with faults, new installations and customer education at reasonable cost. In some cases, however, some operational gaps and maintenance problems, mainly due to the constraints posed by long rough-road distances to cover, were experienced here and there. As an immediate measure, Radio Communication facilities needs also to be augmented with VHF two-way radio to facilitate communication between technicians in the field and the various project offices.

4.8. The existing vehicle fleet (made up of three pick up trucks, one light truck and one cross country vehicle) appears very inadequate for effective field operations. Currently the project has no motorbikes, this means all movement must be by car. Given the wide geographical coverage of the field operations, the vehicular capacity is inadequate, and a comprehensive analysis of vehicular requirements for effective field operations is needed to ensure optimal investment in transportation equipment for post-GEF operations.

5. PRO-ACTIVENESS TO THE CHANGING CIRCUMSTANCES OF THE PROJECT

5.1. The sudden opting-out or exit of the VRA, apparently affected the implementation of the Project. Therefore, in-order not to collapse as a project, the RESPRO had to be established as an autonomous project entity, with the necessity of providing those physical infrastructures for which it had fully relied on VRA; e.g. offices, staff, vehicles, etc. Despite the disruption and delays resulting from the disengagement of the VRA, it is the view of the Evaluation Team that the RESPRO project has properly reacted to this unexpected event, and has fully benefited from the operational flexibility that its status as an independent project unit has allowed.

5.2. The unexpected serious collapse/decline in the value of the national currency; the Cedi, administered yet another sudden shock to RESPRO, by invalidating most of the calculations and assumptions regarding the principle of the “Full cost recovery basis” for the payment of the PV services by the beneficiaries. These difficulties were among the many teething problems faced by RESPRO at the inauspicious period of its operational commencement, and caused some delays in the PV dissemination process. While the RESPRO has appropriately revised the tariffs for PV services, as a part of the trade-off that was necessitated to implement the activities aimed at the development of the PV Market, the uncompetitive fees for the PV services, as compared to the traditional grid options,¹⁵ has led to increasing the frustration among the targeted population. In many cases, the rural households have responded to this inequity issue by refraining themselves from applying for PV systems, showing their preference for the grid option, despite the much longer time needed to get access to the grid, and the highly varying quality of the electricity provision.

¹⁵ Highly subsidized by the Government of Ghana, through its National Electrification programmes.

5.3. Besides this exchange rate issue, it is worth mentioning that this cost barrier can not be resolved by the project itself, but shall be addressed within the broader scope of the national electrification strategy.

5.4. Given all the realities in the field, the state of the national economy, the environment of the VRA/NED and their grid electricity services to the rest of the public in Ghana even up to the Northern districts, the expectations of the full active involvement of the private sector in RESPRO/PV system marketing, immediately or within the three years period of the RESPRO project, appears to be as ambitious as it was perhaps less than realistic.

5.5. However, should the involvement of the private sector and of the associative actors be gradual, it is important to grant this option a full consideration in the future, provided that the PV systems are fairly considered as a viable alternative option to the grid and integrated as such into the National Electrification Strategy, that the technical, financial and institutional conditions for the PV market development in Ghana are in place.

5.6. As at now, even the cost-recovery approach to the PV systems service to Northern rural Ghana, could have a very rough ride, in any serious or critical analysis or debate about its bonafides, the rationality, logicity or justification of that approach. To the ever-calculating, the cost-recovery concept probably smelt foul, in terms of the profit and loss calculations, particularly in relation to the rural target areas, or the poor dwellers of Northern Ghana.

5.7. It is to the credit of the Government of Ghana that, in spite of or despite the teething problems arising at the very inception of the RESPRO Project (the fall of the Cedi; the exit of VRA, the many project implementation delays arising from the cumbersome/bureaucratic tendering bids for the importation of the PV equipment, etc), the Government of Ghana had gone ahead in a spirited search for synergies, new sources of funds, with heart-warming positive results; some loans having since been received from such countries as Spain and Danida (Denmark). These resources were meant for independent PV projects being implemented concurrently with RESPRO. It is the intention of Government for the RESPRO Trust¹⁶ to take over the management of these projects and future ones (expected from USA, Spain and China) after the RESPRO project termination.

5.8. The target groups are taken here to mean the poor rural dwellers in the different districts or widely dispersed village communities in the three Northern Regions of Ghana. At the early beginning of the project, mixed signals coming from the activities of, and some conflicting statements by, national politicians regarding the imminence of the connection to the Grid, its higher reliability and better quality of electricity provision, and its softer financial conditions for the rural people as compared to the PV based electricity. The belief that the PV would exclude any chance to get access to the grid has created such confusion, uncertainty or indecision amongst the target groups as defined above.

¹⁶ This Trust fund is under creation.

5.9. Presently, however, official government policy would appear to have shifted in favour of the PV system or renewable energy-based electricity. Hence the future appears quite bright for the PV system in Ghana after GEF or after 31st December 2002. This indication appears quite clear from some important actions or key policy statements by the Government in recent times (e.g. in its NES & the SHEP programmes in respect of PV-based electricity and its official adoption for bringing electricity services to off-grid communities). On the other hand, following the new positive thrusts of official policy regarding PV-based electricity in Ghana, the RESPRO institutional capacity outfits (the offices with the trained staff and the technicians out there in the field), as well as the target groups, the widely scattered or dispersed village communities all over Northern Ghana, all these now appear to have overcome the earlier moods of uncertainty or the ‘wait and see’ attitude earlier created by apparent contradictions or uncertainties in official policy.

5.10. The visible results of the current situation as above described is quite measurable in the facts that:

- Within 4th quarter of 2002 alone the RESPRO field staff has registered greater numbers of PV system customers than it had done in the previous three quarters;
- This upsurge has resulted in some 243 PV customers having paid up in October 2002 alone and are only waiting for RESPRO to install the PV systems for them in their households. The project coordinator indicated that RESPRO is contracting these installations out to the eighty (80) trained technicians in the private sector to satisfy customers by mid-December;
- Whilst there are general or widespread protests or appeals about the ‘unjust’, ‘high or inequitable’, tariffs imposed on them for the PV systems, yet everywhere the target groups appear fully to welcome the PV systems energy option. They express the positive impacts made on their quality of life, on their small market shops, socio-cultural lives and interactions at their local market squares, public motor parks many of which are now brightened up with the PV security lightings; and which public security lightings enhance the security of lives and property by checking the nocturnal activities of thieves and other social undesirables within the community.

6. ABILITY OF THE RESPRO TO LEARN FROM OPERATIONAL EXPERIENCE IN EARLIER PROJECTS

6.1. On the local scene, RESPRO has benefited from the experience of the Ministry of Energy's implementation of the Wechiau solar pilot project in the Upper West Region, and the Spanish funded Solar project in the Volta Region. Both projects recognized the need to use community-based structures to carry out revenue collection and routine maintenance. RESPRO took this concept a bit further by establishing bonded cashiers in strategic locations to privatise the activity of bill distribution, revenue collection, and the response to minor faults. While much effort is needed to refine this important business process, particularly the need to address the questions of security of cash collected, and dealing with issues of remuneration and motivation of the bonded cashiers and contract technicians, the project's commitment to privatising these functions is efficient and strategically important for creating goodwill in the communities and reducing operational costs.

6.2. On the international scene, RESPRO has also benefited from the experience of PV projects in South Africa where the impact of lack of coordination of PV investments and grid extensions has resulted in quite a number of failed PV investments, primarily because the grid arrived shortly after the PV projects were initiated. In fact, RESPRO has experienced a similar situation in the targeted region, and as a response, has extended the project coverage to other areas in the North to avoid any overlapping with the grid, while initiating a positive dialogue with government and other stakeholders on the need to define the parameters for grid connections and PV concessions to avoid such duplications in the future.

6.3. On the other hand, unlike the South African experience, where there were two separate programmes: one was the programme to provide basic electricity services for un-electrified communities and other was the Schools programme for which the Government provided separate funding, RESPRO did not put enough emphasis on social service programmes, though these were duly mentioned as a part of the project activities (see activity 2.2.3 of the project document). Thus it missed to take advantage of their massive socio-economic benefits to the entire community, and of their positive boosting effect to the PV market. However, RESPRO has recently identified a large number of rural clinics and schools to electrify on a priority basis. Separate funding is being sought for these.

7. IMPACT OF THE PROJECT IN THE PV MARKET IN GHANA

7.1. The project has had a very level impact on the local PV market. Aside from the opportunity to supply and install some equipment, the sheer size of the awareness creation activities of RESPRO is having a spill-over effect, and generating opportunities for sale of PVs all over Ghana. This stimulation in demand, though still in its infancy, can pave the way for an emerging private initiative to develop the Market.

7.2. The impact of the project also appears significant through the role that the PV technology is being granted by the Ghanaian authorities, within the electrification strategy, the future establishment of a specific framework aimed at promoting the PV market, and the exploration and provision of new resources for such development.

7.3. Furthermore the private sector welcomes the opportunity being created by the project, to bring constantly to the attention of policy-makers the unique problems of the solar PV industry. The participation of a private sector representative on the Steering Committee of RESPRO is seen as a positive gesture from Government, and the sector is genuinely excited about this inclusive approach.

8. MORE EFFICIENT STRUCTURES AND DELIVERY MECHANISMS TO ACCELERATE THE DEVELOPMENT OF THE PV MARKET IN GHANA

8.1. In the next phase of the PV Market development, consideration should be given to increasing the scope of participation of beneficiaries in the project management, for example by:

- Increasing the number of beneficiaries in the Steering Committee, as to allow the target population to better reflect their opinions and expectations;
- Better exposing these new members to the field achievements and constraints;
- Formation of Solar Committees at the community level, and formally transferring the ownership and management of Community Facilities (e.g. Street Lights, School and Clinic installations, water pumping systems), to these Committees for operation and maintenance.

8.2. The project needs to move towards developing and enforcing more formal contract of service spelling out more clearly the rights and obligations of RESPRO and the Clients, respectively.

8.3. In the perspective of an effective development of the PV market, and in order to respond properly to the growing needs for the deployment of logistical and personnel resources, and to the increasing geographical coverage, the RESPRO should also seriously put emphasis on the involvement of the private sector, in particular the local actors at village level, when developing the PV market. This involvement should not only include the maintenance, but the whole PV service cycle; i.e. : identification of the beneficiaries, contractual arrangements, installation of the systems, collection of the fees for services, monitoring and maintenance, etc.

8.4. The full participation of the private sector in the development of the PV market is a very challenging approach, but it is certainly the most appropriate approach to create a competitive market, and to ensure the flexibility and the dynamism of the State operational entity that is being established to drive the PV Market development process.

9. OWNERSHIP OF THE DESIGN AND IMPLEMENTATION PROCESS OF RESPRO BY THE GOVERNMENT OF GHANA

9.1. Throughout the project cycle, active participation and control by the Government of Ghana through the Ministry of Energy has been prominent. The Steering Committee which had oversight responsibility over the affairs of the project was composed of very senior staff members of the relevant ministries, together with representatives of the beneficiaries through their elected assembly man from the District Assembly.

9.2. The government, through the Steering Committee has demonstrated full control over the design and implementation process by effecting important changes to the project design and implementation at various stages in the project life to ensure that the project was responsive to the needs of the target groups. The Government has also demonstrated ownership of the process by proactively dealing with the issues relating to post-GEF funding, and the institutional arrangements necessary to transition the project for future private-public participation.

10. LINKAGES BETWEEN THE PROJECT AND OTHER RELATED INITIATIVES AT THE NATIONAL LEVEL

10.1. At the national level, several government and private sector initiatives will have direct and indirect linkages with the RESPRO project, some of these are activities to be funded directly from the HIPC savings, and include:

- Intensive program to increase the access of rural communities to electricity for productive uses from 15% to 20% by 2004;
- Incentives for the expansion of renewable energy services, particularly to the poor;
- Support for the establishment of 50 agro-processing plants in the northern region and coastal savannah. PV services can be used to energize some of the proposed enterprises in the project area;
- Incentives to attract entrepreneurs into modern, irrigated agriculture and agro-processing, are underway. PV services from RESPRO can support irrigated agriculture, in several irrigation projects, particularly at Tono, Veve, and Bontanga irrigation dams in the Northern and Upper East regions;
- The Schools Electrification Programme, under the Education Sector Support Project proposes to electrify 350 rural schools through PVs before the end of 2002;
- The upgrading of Health Centres in rural areas. There is currently on going, a massive programme of constructing new clinics and refurbishing and equipping existing clinics. In many cases, as a result of its cost-effectiveness and reliability, PV electrification of these clinics is being considered as the only viable option for lighting, vaccine refrigeration, laboratory investigations, and similar services.

10.2. These programmes could create a sustained market for RESPRO, and benefit from the human capacity that has been developed by RESPRO for both installations and maintenance.

11. EFFECTIVENESS OF THE PRODUCTION OF THE PROJECT OUTPUTS

□ Achievement of the Development Objectives of the project

11.1. The RESPRO has been pursuing a number of development objectives :

11.2. **First**, the project contributes to meeting the priority needs of Ghana, related to sustainable economic and social development and poverty alleviation, through a better access to new environmental-friendly and carbon-free technology applications, such as PV systems, to the benefit of rural population.

11.3. Through testing various approaches and models for widespread dissemination of PV systems in Ghana, the project also provides a unique opportunity to establish an adequate framework for large-scale dissemination of PV systems technologies, in the future. On a longer term, this will allow for significant reduction of the growth in greenhouse gas emissions, in comparison with a business as usual option consisting of fossil-fuel based electricity generation models.

11.4. **Second**, while the project itself doesn't lead to significant direct CO2 emission reductions, given the limited number of households to be directly equipped by the project, it would, at a longer term, and with the development of the PV market, have much more significant global environmental impact, in particular when taking into account the likely growing contribution of the fuel-based facilities in electricity generation mix Ghana, at the expenses of the hydro-power facilities.

11.5. As the project is building a large consensus among the decision makers, and among the target beneficiaries, on relevancy and appropriateness of the development of PV market in Ghana, it is the view of the Evaluation team that the project will have a valuable contribution to push the development of PV systems to the up-front priority agenda in the electrification strategy targeting the remote areas in Ghana.

11.6. Through the demonstration of the reliability of the PV technologies, and the effectiveness of the market development, the project will also help catalyze similar processes elsewhere in the region and in the world.

11.7. **Third**, despite the "teething" problems faced by the project, and regardless of the management approaches of the process, this project demonstrates the feasibility and sustainability of providing decentralized renewable energy electricity services targeting rural communities, while ensuring high level performance. While the project demonstrated the limited ability of the target beneficiaries to pay the PV services, on a full cost-recovery basis, this ability to pay should increase dramatically in the future given the important economic, and social side effects implied by accessing to electricity services.

11.8. The project has put into evidence the cost-effectiveness of the electrification of the rural areas through PV systems, in comparison with grid connection. Moreover, the PV development is not only to be seen as a pre-electrification measure, but also as a viable longer term electrification option, providing effective economic, social and cultural benefits to large target groups in rural areas.

□ **Achievement of the Immediate Objectives of the project**

11.9. The project has four immediate objectives, the achievement of which should contribute to the development objectives of the project:

- **Immediate Objective 1** : Increase the Government of Ghana's understanding of the technical requirements, equipment options, and capital and operating costs for use of PV-based energy systems, both as stand-alone units and in hybrid power systems, for rural electric power delivery;
- **Immediate Objective 2** : Demonstrate the technical, economic, institutional, and social feasibility of sustainable large-scale diffusion and application of small-scale PV units and hybrid power systems to the people of Ghana, government officials, the private sector, and the international development community – Implement Field Activities;

- **Immediate Objective 3** : Communication, Education, Training and Outreach;
- **Immediate Objective 4** : Preparation of Post-GEF commercial operations and expansion
- ✓ **Immediate Objective 1** :

11.10. Except for some outstanding activities, RESPRO was able to implement almost all the activities planned under this Immediate Objective1.

11.11. The project has established a Project Unit totally dedicated to the project implementation, with an Office based in Tamale. The project has also established an appropriate staffing structure, with 20 persons fully working on the project activities, supported by some five technical staff. The project Inception Meeting took place in February 1999, and the programme and budget plan released subsequently.

11.12. Regarding the activities 1.2.1 to 1.2.5,¹⁷ the project was supposed to receive full support from NREL. However, NREL did not identify or assist RESPRO to establish any communication links with any other relevant international programmes despite several reminders from the project coordinator. In the final analysis, RESPRO had established by its own contacts with similar projects for organizing its study tours, and had to get assistance from Isofoton SA of Spain to arrange training for project technicians. Isofoton SA also assisted RESPRO to obtain International Standards especially E.U standards for PV equipment and free-standing systems. The RESPRO Website is ready and was being operated in November 2002.

11.13. It is indeed regrettable that the collaboration with NREL did not take place as the RESPRO would have certainly taken benefits from such collaboration, with better interactions and exchange with other PV dissemination experiences, and more international exposure and visibility of the Ghanaian project.

11.14. To some extent, the project was also able to establish a training, Evaluation, and Qualification Facility at the RESPRO level, and had undertaken multiple numbers of training and awareness initiatives. In addition, the project coordinator had the opportunity to undertake a Study Tour to Uganda, Kenya, Zimbabwe and South Africa, in order to learn from their experiences. It is the view of the Review Team that other personnel from the project could also participate in some international fora and to training workshops, in particularly in Spain. Other planned Study Tours, mentioned in the project document have not been yet undertaken. These study tours were not undertaken because at the time they should have been undertaken, the procurement process for materials had delayed so much, that the obvious priority became to sort out the daily tasks, and start immediately with the dissemination activities.

¹⁷ Namely : Activity 1.2.1. Communication with relevant programmes elsewhere, Activity 1.2.2. Commercial Renewable Energy Equipment Database and Assessment, Activity 1.2.3. International Standards – PV Technologies, Activity1.2.4. Technical standard – Hybrid Power Systems, 1.2.5. Electronic Communication Network and Web Site.

11.15. The project was also able to make equipment procurements to facilitate personnel training, PV testing and installations as well as other field activities. There was some limited procurement of solar equipment with accessories for community-based applications.

11.16. RESPRO has also undertaken rural energy surveys and community outreach activities. The report of these surveys is available at the RESPRO offices.

✓ **Immediate Objective 2 :**

11.17. The project has demonstrated the technical, economic, institutional, and social feasibility of sustainable large-scale diffusion and application of small-scale PV units. At the moment, however, the installation of hybrid power systems and of low-voltage mini-grids has not taken place. According to the project coordinator, this has not taken place because of the very dispersed nature of the houses in the communities.

11.18. Up to September 2002, almost 1800 PV systems were reported by RESPRO as having been installed in the target regions for the beneficiaries (some households, some clinics, and some schools in the Secondary and tertiary education sector, etc.). Two monitoring stations for collecting meteorological measurements have also been installed by the project.

11.19. These equipment have been installed with the support of the three field facilities established at the early stages of the project implementation (at Nakpanduri, Binde and Bunkpurugu).

✓ **Immediate Objective 3 :**

11.20. As stated by the Project Document, RESPRO had undertaken a number of collaborative activities with relevant NGOS and Universities. In addition, communication-related and outreach activities have been carried out during the course of the project.

✓ **Immediate Objective 4 :**

11.21. Activities included under this Objective were partly launched. Market Survey and Market Entry Assessment are still outstanding. RESPRO is currently in the process to preparing the Business Plan and a Financial Plan for the post-GEF development programme.

11.22. In particular, RESPRO is presently discussing with the Ministry of Energy for the establishment of a Non-profit Trust as a post GEF organization, to carry forward the development of PV market in Ghana. Currently, there is a Cabinet Memo under discussion at the highest governmental level.

11.23. In addition to the above cited efforts, the Government of Ghana is currently engaged in high level inter-governmental discussions with SPAIN, CHINA and USA for the purposes of sourcing fund, for the post-GEF RESPRO-Trust PV activities. There are very positive expectations coming from these partners. As a matter of fact, SPAIN has already expressed some positive interest in contributing to the future development of the PV market in Ghana.

□ **Effects of project activities with respect to target groups**

11.24. The evaluation team inspected and interviewed members in those village communities now equipped with PV lighting in their village schools, or with a water pumping mechanism powered by the PV system. These new developments are clearly having remarkable impacts on the people's lives; those involved in small trading activities and other commercial enterprises (marketing of petroleum products, sale of local drinks – Pito – sales of tapes and video cassettes, barbing salons etc) are facing life with renewed hope and confidence with the great sense of belonging with those in the metropolis in one country as all Ghanaians and citizens of one country.

□ **Significance of the project results for the targeted region and for country**

11.25. The RESPRO project has been appropriately described as a pathfinder project. A pathfinder in the search for appropriate energy solutions to rural poverty. The project has not only demonstrated the technical viability of PV systems as an optimal solution to the energy needs for small loads: lighting and the operation of small appliances, but it has also shown that this option is the most cost-effective for remote, and dispersed settlements such as in East Mamprussi district or the Tengzuk area which is difficult to reach because of surrounding hills. Such locations are many in Ghana, for example the whole of the Upper West Region, Afram plains district in the Eastern Region, and the many islands on the Volta river, are all sites with similar geographic, demographic and settlement characteristics which justify the use of PV for electrification rather than the grid as both more cost effective, more rational and logical.

11.26. RESPRO has demonstrated that stand alone PV services can revolutionize rural health service delivery by making water pumping feasible, enabling laboratory investigation, task lighting, vaccine refrigeration and surgical operations to be performed efficiently. In the Northern region alone, there are 45 un-electrified rural clinics. Similarly, 100s of rural schools, and water points can all be electrified using PV to improve the quality of life of rural inhabitants. These project results could be replicated on a big scale in the region, and indeed in the country as a whole. The political will exists for such replication and up scaling (See GPRS, 2002). What is needed is the institutional and regulatory framework that will ensure that PV energy services can be integrated fully into the energy development and investment program in the country.

11.27. On the down side, the project experience has revealed that, any attempt to promote in the rural areas, a commercial, full-cost recovery basis solar PV program in a country like Ghana, (with an extensive rural electrification program based on the grid, and an established pricing policy that subsidizes low consuming grid connections) will lead to inequities and further deepen the disparities of benefits derived by consumers from grid and PV connections. A commercially-oriented PV program will also lead to the virtual exclusion of the poor, given that, the penetration rate in some of the target communities is less than 20% even under the currently subsidized tariff.

□ Possibility to obtain more significant results

11.28. The RESPRO could, without any doubt achieve more significant results, provided that full consideration is given to address two major issues: (i) equal treatment of the two technical options for electrifying the remote areas; i.e. the PV systems and the grid based system; (ii) parallel interest to social needs, such as healthcare and schools.

11.29. First, it's important to create a more level playing field in the matters of electricity bills paid by the Grid-electricity consuming metropolitan Ghana citizens and their rural-village based fellow citizens fed on the PV-based electricity. The Northern based citizens of Ghana complain that they face more than enough hardships or handicaps arising from the nature of their peculiar environment, and therefore ought not to be further burdened selectively with the cost-recovery concepts, in the PV electricity services.

11.30. The Northern region, and the Ghanaian Nation as a whole will begin to reap greater benefits of PV based electricity, when the same programme is extended and used (within the current official philosophy of NES, SHEP and GPRS) to reduce many of the persisting, but avoidable, national losses of Ghanaian motherhood and the greatest natural wealth resource, the children and youths who needlessly die prematurely.¹⁸ Inadequate reproductive health services compounded by the shortage of requisite personnel and logistics, including the electricity services, were among the killer-constraints cited. By no doubt, the access to electricity would substantially contribute to improve the situation, and thus to increasing the overall welfare of the population.

11.31. The good results already achieved by the RESPRO project in different parts of rural Northern Ghana will, without any doubt, become much more significant in the socio-cultural and economic terms if the Government (through its NES & SHEP programmes) mandates the installation of hybrid PV systems in as many schools and clinics/hospitals as can be rationally done, while taking into account the population densities in the neighbourhood of these social/cultural facilities.

□ Project Completion

11.32. The project completion was programmed for the end of march 2001. From all accounts, the evaluation mission think it possible **to improve the project outcome significantly**, if some measures are taken, provided that the project is allowed for an extension by a few months. These measures don't entail additional activities, they only aim to exploit the project results already achieved to date.

¹⁸ A recent publication in one of the Ghana news media "Death in Pregnancy and Childbirth is preventable: Act now" (see Daily Graphic Newspaper of Friday 25th October 2002) bears quoting at this juncture; "The Northern region continues to record the highest incidence of maternal anorbidity and mortality rates in the country. The region recorded about 4000 deaths out of the 100,000 live births in 2001 (In the contrast, the national mortality rate is estimated at only 200 per 100,000 live births), and about 500 pregnant women also died during delivery.

12. SUSTAINABILITY

12.1. The RESPRO project has demonstrated the social and economic benefits, as well as the technical feasibility of the PV systems in Ghana. Besides the evidence acquired regarding the cost-effectiveness of the PV option in remote areas as compared to the grid-based electricity, the RESPRO has also allowed to capitalize a very valuable experience on the approaches and modalities as well as on the logistical, human and financial resources needed for the development of the PV market.

12.2. In addition, despite the short duration of the project, the RESPRO has contributed to convincing the Ghanaian Government of the relevancy of such electrification alternative, and of the necessity to fully integrate the PV dissemination within its electrification strategy. The multiple follow-up initiatives, launched by Ghana, aimed at providing new resources for PV development, with possible support from Spain, USA, China, etc., and at establishing adequate institutional framework (e.g. the possible establishment of a RESPRO TRUST), provide clear signals of the Ghanaian intentions for the development of the PV technology.

12.3. Thus, the Ghana Government can surely very successfully ensure the sustainability of the process implemented so far, through its current strategy. The Government of Ghana may also consider reviewing the inequitable cost-recovery burden on PV systems to maximize the chances of success of the disseminating initiatives. It can quite usefully take on board the PV system into its NES/SHEP, as already spelt out in some of the key official policy documents published in very recent times.

APPENDICES

APPENDIX 1

TERMS OF REFERENCES OF THE FINAL EVALUATION MISSION

UNITED NATIONS DEVELOPMENT PROGRAMME

GLOBAL ENVIRONMENT FACILITY

TERMINAL PROJECT EVALUATION

The Ghana Renewable Energy Project (RESPRO), started in February 1999, and is being implemented by the Ministry of Mines and Energy through Renewable Energy Services Project unit on the basis of what is known as "National Execution". The Government of Ghana and The Global Environment Facility (GEF) fund RESPRO with technical support from the National Renewable Energy Laboratory of the US Department of Energy. The project phase is three years after which the lessons learned will enable a public sector company to efficiently provide rural energy services. The project addresses the need to find sustainable energy paths for social and economic development that can use renewable energy based electricity and fuel supply technologies in place of fossil fuel-based electrification

Specific objectives of the project are (1) to increase the Government of Ghana's understanding of the technical requirements, equipment options, and capital and operating costs for the use of photovoltaic (PV) energy systems, both as stand-alone units and hybrid power plants, for rural electric power delivery; (2) to demonstrate in Ghana the technical, economic, and institutional feasibility of sustainable large-scale diffusion and application of small-scale PV units and hybrid power systems to the people of Ghana, government officials, the private sector, and the international development community; (3) to enable the Volta River Authority/Northern Electricity Department (VRA/NED) to integrate the use of renewable energy systems into its ongoing rural electrification activities; (4) to provide electricity to thirteen off-grid communities in a remote area of Ghana; and (5) to catalyze large-scale use of these technologies in the country. With privatization of NED, it is expected that this operation will be incorporated into the private sector activities of NED in providing rural electricity services with and without "the wire".

B.2 Expected End-of-Project Situation

At the end of the three-year project, it is expected that PV-based electricity services will be reliably available throughout the pilot region, and that there will be in place a private profitable rural energy services company established as a division of the privatized Northern Electricity Department (referred to here as "NED, Ltd."). At that time the costs and technical, personnel, institutional, and socio-cultural requirements for launching and operating a successful rural electricity services enterprise will be established, and the framework will be in place in Ghana to attract wide private sector investment in companies to provide rural energy and related rural infrastructure services. In some of the larger communities there will be PV/engine hybrid power units powering low-voltage (220 VAC) 4-wire mini-grids to supply electricity for commercial and community operations in village "micro-enterprise zones", with electricity services provided on a fee-for-service basis.

Specific expected achievements include the following:

- (a) As a result of the presence of a commercial infrastructure for providing reliable decentralized electricity services, co-investments in socially and economically productive activities will have been made, enhancing the value of the electricity, and contributing to sustainable social and economic development throughout the District. There will be increased levels of literacy and education -- for children and adults -- through the use of educational media such as TV/VCRs and computers;
- (b) Commercial firms, including (and perhaps dominated by) international/Ghanaian joint-venture companies, will be actively establishing rural energy and infrastructure services companies throughout northern Ghana.

- (c) The World Bank, through the Solar Development Corporation, and other international financial institutions (IFIs) will be providing initial capitalization and support to many of these new rural services enterprises.
- (d) The Government of Ghana, taking advantage of the availability of reliable high-quality electricity services in previously unelectrified regions of the country, will (through the ministries responsible for health, water, education, and agriculture) make investments in upgrading schools, health posts, water supply facilities, and support for small-scale farmers. The electric school house will begin emerging as a new standard for rural Ghana, using satellite educational television and videocassettes, and computers to bring information, literacy, and education into rural Ghana. Health posts will be upgraded substantially, and increasingly, boreholes will have PV water pumping and continuous disinfection systems operating, to assure safe water and to promote good health.
- (e) A new indigenous industry will emerge to supply new products for the village power market, including specialized lights, small energy-efficient refrigerators, TV sets, small power tools, grain millers, sewing machines, vacuum packing units for agricultural products, etc.
- (f) Commercial suppliers of PV equipment and related appliances will emerge, probably as adjuncts to existing companies, with ties to international suppliers, to supply the needs of rural energy and infrastructure services organizations.
- (g) The UNDP will increasingly incorporate sustainable energy technologies into its country programs for poverty alleviation, micro-enterprise development, agriculture, water supply, and education.
- (h) Rural communities in the pilot region will experience new economic growth, improvements in public health, and greater well being.

In addition to these end of project conditions, the eventual widespread use of photovoltaic systems for small scale and community energy needs in Ghana is expected to:

- Reduce the use of kerosene in rural areas;
- Reduce the growth of thermal power generation for rural electricity services;
- Support improvement in rural medical and educational services;
- Reduce indoor and outdoor air pollution;
- Reduce emissions of carbon dioxide, particulates, NO_x, and SO_x;
- Support the establishment of economically productive activities including handicrafts, cottage industries, higher output farming, and food processing.
- Provide greatly superior electric lighting at costs comparable to present expenditures for kerosene lighting.
- Provide access to community micro-grid electrification services at costs comparable to present total expenditures for kerosene, dry cells, auto batteries, and battery charging services.
- Stimulate the establishment of an indigenous PV industry;
- Stimulate North/South and South/South cooperation and collaboration in PV technology and applications

I. Objectives of the Evaluation

The UNDP CO has initiated the evaluation in compliance with the provisions of the project document

The evaluation is being undertaken in order to assess and document the experience to date with the design, implementation, impact and potential for success of the RESPRO project and suggest improvements that can be made to the project.

Specific objectives of the evaluation are to:

1. Identify elements and characteristics of project design, implementation, government policy and the local context which have had an impact on project performance to date;
2. Assess how the project has been implemented and if optimal use has been made of the available human and material resources provided;
3. Assess the sustainability and replicability of the achievements of the project to date;
4. Analyze and document the roles played by different stakeholders in different parts of the project cycle and their impact on project performance;
5. Estimate the potential impacts of the project on global efforts to reduce greenhouse gas emissions;
6. Make specific recommendations regarding project structures and delivery mechanisms so that implementation can be accelerated during the remainder of the project.

The main stakeholders of this evaluation are the Government of Ghana, specifically the Department of Energy in the Ministry of Energy and Minerals Development; Ghana Renewable Energy Association; participating financial institutions and NGOs; UNDP and GEF.

II. Scope of the Evaluation

The evaluation will cover aspects of the project including:

1. Key constraints to PV market development in Ghana;
2. Project structure, linkages to Government, private sector and other stakeholders;
1. Operational efficiency of the project structure and the suitability of present staffing;
2. Equipment procured under the project including office and communication facilities;
3. Stakeholder involvement in project implementation;
4. Delivery mechanisms;
5. Credit mechanisms;
6. Targets and types of capacity building;
7. Development of codes of practice and equipment standards;
8. Marketing and consumer awareness programs.
9. The pilot nature of the project
10. The geographic/regional coverage of the project
11. Time and planned duration of the project

III. Issues to be Addressed by the Evaluation

1. Assess the relevance of the project to the development priorities of Ghana.
2. Based on limited operational experience, analyze the effectiveness of the approaches used to carry out the activities listed above.

3. Assess the capacity and evaluate the adequacy of institutional arrangements for execution and implementation including monitoring and evaluation functions.
 4. In which areas and in which manners has the project reacted to changing circumstances including the elimination of the NEX unit, instability in the Ghanaian financial community, requirements for Government approvals, etc.
3. Analyze whether learning from operational experience in earlier projects is reflected in the implementation of the RESPRO
 4. Document the impact the project is beginning to have on the market for PV in Ghana.
 5. In which ways can the structures and delivery mechanisms of the Project be altered in order to accelerate implementation.
 6. Address the question of whether the design and implementation process are owned by the government.
 7. Look at the linkages between the project and other related initiatives at the national level.
 8. The type of outputs being produced. Is the project effective in the production of outputs?
 - Are the outputs likely to achieve immediate objectives?
 - Can surplus be improved?
 - Has there been an impact on Greenhouse Gas emissions?
 - - Are the effects of project activities positive or negative with respect to target groups?
 - Are the results of any significance for the country or region as a whole?
 - Could the results be made more significant?
 9. Sustainability
 - The mission is expected to address the issue of sustainability of the project. The main focus here is the extent to which the project is supported by the Government and the degree to which the project is integrated into national programme. The issue of sustainability is related to what happens post-GEF, particularly the prospect of its being transformed into profit making oriented entity.
 10. Lessons Learned
 - The mission should review broad lessons learned from project development and implementation.
 - Specifically,
 - (a) how could impacts/results have been achieved more effectively or efficiently?
 - (b) what should be done differently in a similar project?
 - (c) what should not have been done because of its negative or insignificant impact on the overall objective of the project.

IV. Products Expected from the Evaluation

The evaluation mission will determine the extent to which the project has so far met its objectives and draw lessons based on the implementation of the project. The evaluators will also make recommendations and conclusions reflecting the objectives listed above and the best way forward.

V.. Composition and itinerary of the mission

In order to preserve the independence and integrity of the mission, no member of the mission should have participated in the formulation or execution of the project.

The mission will be composed of:

An independent team of consultants will undertake the evaluation. The team will be composed of three members - two international consultant (a PV expert who is the Team Leader and has a substantial experience on the design and implementation of renewable energy and global environmental change and a Socio-economic expert who is highly experienced in evaluation of developmental impacts of projects) and one national consultant. All the three consultants must in addition have a wide experience with the United Nations system.

-The duration of the mission will be 8 days (4 days in the field and 4 days for finalizing report).

- The mission will commence in the third week of October.

-The mission will maintain close liaison with UNDP Resident Representative in Accra and relevant Government Ministries.

- The UNDP, Accra, will provide necessary advice and assistance on any pertinent matter.

Preparation of the evaluation report

-The Preliminary Results and recommendations of the evaluation will be discussed with the Government and UNDP-Accra.

-The final report shall be submitted to UNDP-GEF no later than two weeks after the field visit.

Tripartite Meeting

A Tripartite meeting will take place after the evaluation to discuss the results and recommendations.

APPENDIX 2

OFFICE MEETINGS MADE BY THE EVALUATION TEAM

The evaluation mission commenced on the 21st of October 2002 in the Capital city of Accra, Ghana, with series of meetings and discussions between the Evaluation Team and the different cadres of well informed management staff of the government ministries, as well as between the Evaluation Team and officials at the UNDP. The offices visited included:

- The Ministry of Finance: meeting and discussions with the Director of External Resource Mobilisation (ERM);
- The Ministry of Energy: meeting and discussions with the Energy Policy Advisor;
- Meeting and discussions with members of the RESPRO Steering Committee headed by the Director of ERM;
- Two meetings with officials at the UNDP office on the 21st, and again on the 22nd October.

The discussions in each of these meetings centred on the activities and experiences of RESPRO since its inception about July 1999; some assessment of its operational problems, and the future prospects of the RESPRO Project in Ghana after 31st December 2002.

The details of the office meetings are listed below:

| Date | Meeting with: |
|-----------------|---|
| 21 October 2002 | UNDP |
| 21 October 2002 | Ministry of Finance – the head of the External Resource Mobilization Unit |
| 22 October 2002 | Ministry of energy – The Adviser of the Minister, the Head of the Renewable Energy Department |
| 22 October 2002 | Members of the Steering Committee |
| 24 October 2002 | RESPRO Office - Tamale |
| 26 October 2002 | UNDP |

APPENDIX 3

FIELD VISITS UNDERTAKEN

On conclusion of the series of discussion meetings in Accra with the main stakeholders involved and interested in the process of PV systems dissemination (see Annex 2), the evaluation mission next moved to the field of RESPRO activity in the Northern Districts/Regions of Ghana.

It may not be very necessary to list the names of all rural places and visited by the team and all the persons interviewed in their widely dispersed cultural/indigenous living patterns. However, the description of the field visit below may give a good appreciation of the level of geographical coverage and the variety of circumstances that the Evaluation mission had the possibility to perform.

In three days of field tours by road, covering some 2000 km, the Evaluation Team had the opportunity to visit more than twenty PV installations and to interact very closely with clients/customers of the PV systems, mainly equipped by the RESPRO. The Evaluation Team had also the possibility to interview a number of potential users, of which, some have already applied for a PV systems and are waiting their installation, and some others are unable to have access to the PV systems, due to financial reasons.

The Evaluation Team returned to the RESPRO headquarters at Tamale on the night of Friday 25th October, and then went into detailed discussions on many issues, requiring further data and information arising from the upcountry tours to the rural dwellers. The discussions lasted some four hours, ending about 10:30pm with a visit by the evaluation team, in company of the RESPRO field coordinator to inspect the four large warehouses housing substantial quantities of the PV systems products, equipment and spare parts etc.

Details of the field visits

| Date | Place | PV System Installed | Person(s) interviewed |
|----------|--|---|---|
| 23/10/02 | Bimbagu Junior Secondary School (JSS) <ul style="list-style-type: none"> • 6 teachers • 108 pupils | 250 Wp PV system installed for 2 years | i) School Teachers including the Headmaster Mr. Konlan J. Dubik ii) A class of the students in JSS 3 <i>Teachers and clients reported positive impacts of the PV systems on the learning environment. Children were using the classrooms at night for private studies, while teachers could arrange extra classes at night to prepare students sitting the Basic Education Certificate Examination. The head teacher pointed out the availability of PV lights in the school building was one important contributory factor to the improvement in the performance of his students in Basic Education Certificate Examination in the recent times. The same classrooms were being used some nights of the week for adult literacy classes for the village.</i> <i>Mr Konlan J. Dubik also mentioned that he would very much like to install a PV system at home, but due to financial reasons, he can not afford such system.</i> |

Details of the Field visits (continued)

| | | | |
|----------|---|---|--|
| 23/10/02 | Navrongo | 300 Wp | Dan Luguzuri, businessman into Ostrich bird farming, cashew nut farming and environmental conservation projects. <i>Originally connected as a fee-for-service client, as back-up to a grid supplied household. Customer is very satisfied with the functioning of the system, and has offered to pay outright for the system.</i> |
| 23/10/02 | | 100 Wp | Mrs. Nazifat Mohammed |
| 23/10/02 | | 100 Wp | Mrs. Kasela Anyama and son Mr. Benjamin Anyama |
| 23/10/02 | Binde Health Centre a Catholic Mission Owned Centre | 200 watt with inverter | Dr. John Alberti/Rev Fr. Bonnet. The clinic is a 45-bed ward now being upgraded to 75 bed hospital, with water, two vaccine and laboratory refrigerators, water pumping facility, laboratory computer. The health center is equipped with PV systems since 1995 <i>The health centre is able to render very efficient medical services thanks to a well functioning pv system which supports all the critical medical equipment.</i> <i>RESPRO is intending to contribute to upgrading the PV system to meet the growing needs of the centre</i> |
| 23/10/02 | Visit to the Binde Village | | Discussion with Paul Mamara – fee-for-services collector |
| 23/10/02 | Binde Water Pump site | 200 Wp PV system installed for 2 years | Paul Mamara <i>Paul Mamara is the pump supervisor. Trained by RESPRO this gentleman performs many roles in the community. He supervises the operation and maintenance of the solar water pumping system, collects revenue, and reports faults to RESPRO for action.</i> <i>Due to the success of the operation, RESPRO is intending to equip 3 additional water pumping sites with PV systems</i> |
| 23/10/02 | Binde | Street lighting | |
| 23/10/02 | Najong Village I | 100 Watts Installed since December 2001 3 bulbs + 1 tape recorder | Mr. Dipaaba Kombong <i>Another satisfied customer ! Only complaint was high tariffs. A close examination of installation and use pattern revealed that a 50 Watt system would meet his essential needs just as well. Customer was advised to consider downsizing his system by discussing with RESPRO.</i> |

Details of the Field visits (continued)

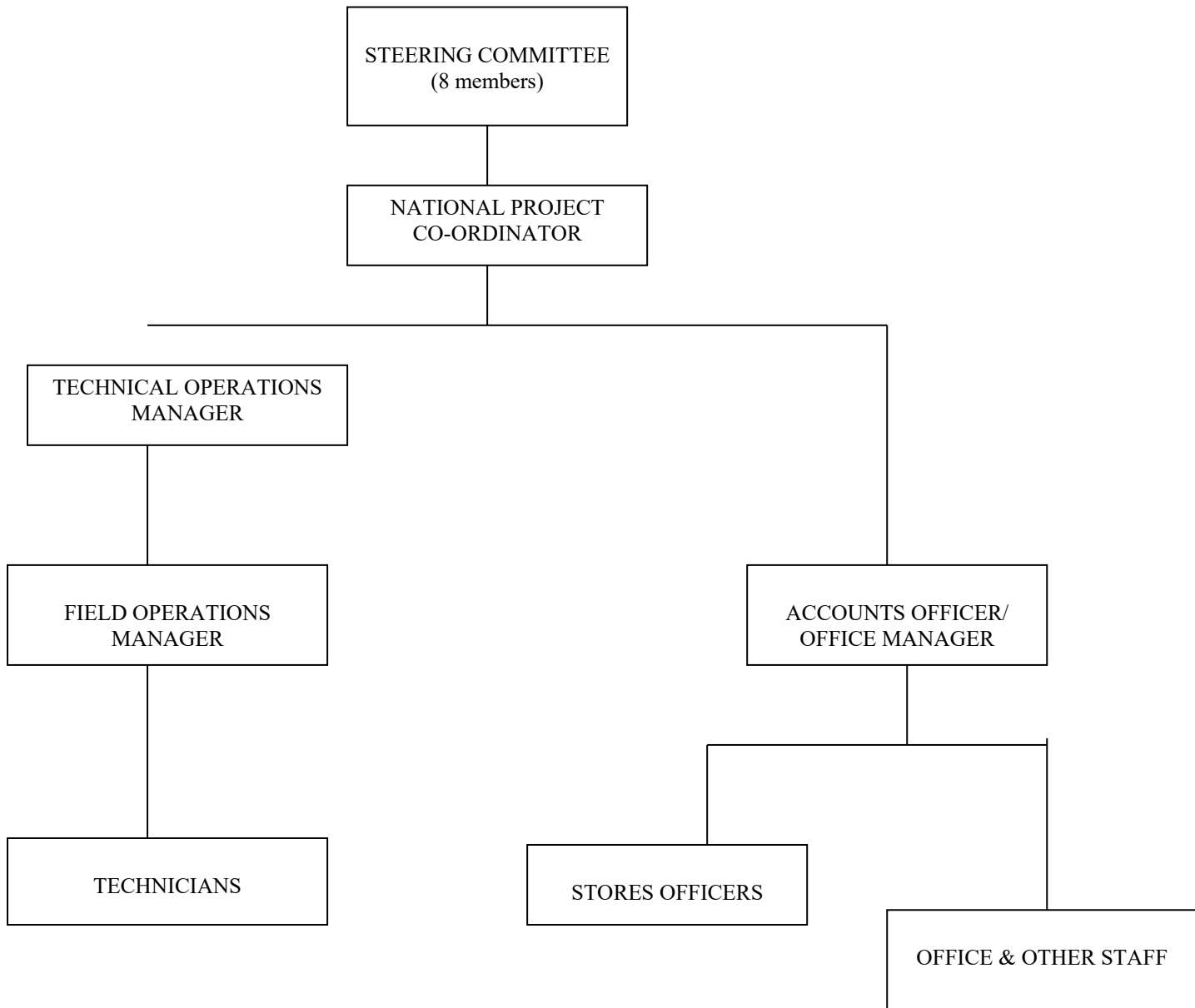
| | | | |
|----------|--|---|---|
| 23/10/02 | Bunkpurugu; and the RESPRO Office battery charging station | 400 watts 500 watts 400 watts | <p>Technicians trained and by RESPRO. Five of them, including Mr. Takna Dickson (revenue collector), interviewed by the Evaluation Team.</p> <p><i>The effort by RESPRO to train village level operation and maintenance staff is highly commendable. While the level of competence of the village level operation and maintenance staff is not extremely high, they are knowledgeable enough to handle installation of basic home systems, replace lamps and fuses and diagnose common faults. This is the kind of skill that is essential for sustainable operation and maintenance of PV systems in a rural and remote location.</i></p> |
| 23/10/02 | Bunkpurugu | 100 Wp | <p>Mr. Siat Kanturib, teacher; member of District Assembly</p> <p><i>Siat re-emphasized reliability of the PV systems and the positive impact that they had on the educational system, particularly with respect to the ability of teachers to prepare adequately their lessons at night and the opportunity of school children to study an hour or two at night. He pointed out that there is concrete evidence that the performance of children in the town at the Basic Education Certificate Examination had improved as a result of the introduction of PV lighting into the community. He also commended the project for maintaining a good rapport with the community and responding promptly to customer complaints. He however made it quite clear that the tariffs for solar PV system as they currently stand are socially unjust and highly discriminatory against the poor rural folk who receive a lower level of service and pay a higher price.</i></p> |
| 23/10/02 | Bunkpurugu | PV Street lighting- PV equipped Shops, drugstore, barber, office of the transport Union, etc. | <p>Market place</p> <p><i>Discussion with the Drugstore, that was equipped since 1999. Very satisfied with the PV system (100 Wp)</i></p> <p><i>Discussion with the Barber, that was equipped since 1999. Very satisfied with the PV system, which allowed a significant increase of his turnover. Still thinks that 25,000 Cedis fee is too expensive.</i></p> <p><i>Office of the Transport Union. Very satisfied with the PV system. They used to have higher operating costs when using candles and lanterns, before they acquired a PV systems. The office also acknowledged the prompt intervention of the RESPRO to fix a technical problem that they had in the last months.</i></p> |
| 24/10/02 | Navrongo | 300 W | <p>Visit to an NGO that is connected to the grid, but is also equipped with a PV system due to its better reliability, particularly for operating computers and other office electronic devices.</p> |

Details of the Field visits (continued)

| | | | |
|----------|----------------------|---|---|
| 24/10/02 | Navrongo | | Visit to a Bar that is connected to the grid, but is also equipped with a PV system. |
| 24/10/02 | Navrongo | PV system installed for one year | <p>Visit to a Shop that is connected to the grid. <i>The grid is mainly used to operate a fan, while the shop relies on PV system for lighting. The system was installed to compensate for frequent power cut, and also for security reasons at night.</i></p> <p><i>The shopkeeper declared that she's willing to cancel the contract with VRA and to purchase an additional PV to operate the fan.</i></p> |
| 24/10/02 | Navrongo | PV system installed for 3 months | <p>Isolated house (the premises are also used to sell traditional beer). The PV system is supplying electricity for 3 bulbs</p> <p><i>The light has allowed to increase her turnover</i></p> <p><i>One of the bulbs was not operating due inappropriate location (just below the tiles. This resulted in water intrusion inside the lamp). The lady did not try to fix the problem.</i></p> |
| 24/10/02 | Tenzuk | <p>Some 41 houses using PV systems from 50 watts to 200 watts</p> <p>59 other households have not yet acquired PV systems</p> | <p>Baura Zuurr; John Bawazuri; David Golden Tiger Bora; Mrs. Basua Turre; John Dagbaa</p> <p><i>Generally customers reported being satisfied with the quality of service. Some complained about unreliability and problems in operating their systems.</i></p> <p><i>Many complained about high tariffs, and referred to grid tariffs which were much lower for life-line customers.</i></p> <p><i>One of the houses visited belongs to a District Assembly member. He is equipped with a 200 Wp PV and has an inverter, allowing him to use a video tape. He used to have a diesel generator before acquiring the PV system.</i></p> |
| 24/10/02 | Tamale | | Visit of the Warehouse. About 400 panels stored. Also a large number of spare parts and battery systems. |
| 25/10/02 | Travel back to Accra | | |

APPENDIX 4

PROJECT ORGANISATIONAL STRUCTURE



Members of the Steering Committee:

1. Ministry of Energy
2. Ministry of finance
3. Ministry of Environment and Science
4. Volta River Authority (VRA)
5. UNDP
6. One representative from the private sector (SOLACO)
7. One District Assembly Representative (East Mamprussi)
8. The National coordinator of the UNDP-Small grants

APPENDIX 5

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