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CONSULTING FIRM IN COMMUNITY SOCIAL DEVELOPMENT

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**EXTERNAL EVALUATION OF THE PROJECT
“MICROENTERPRISE DEVELOPMENT BY MEANS OF
RENEWABLE ENERGY IN THE *EL QUICHE* REGION”
UNPD-GUA/99/G35 GEF/FMAM
*Final Report***

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I. EXECUTIVE SUMMARY

The project “Microenterprise development by means of renewable energy in the *El Quiche* region”, PNUD-GUA/99/G35; GEF/FMAM began in 1998 with the generation of PDF block A, which identified a project and strategies portfolio for developing renewable energy projects in the Zonapaz region that were congruent with operational program 6 of the GEF and was formally started on July 1st, 2000, after carrying out a management phase in order to develop possibilities of constructing a local instance capable of providing rural energy services.

The goals in the environmental context are geared towards the mitigation of climate change through the displacement (total or partial) of traditional (candles, ocote, etc.) and fossil sources of energy (diesel, kerosene).

The project intends to remove financial, institutional and development barriers through the implementation of innovating financial and organizational schemes and strengthening local capacities in the influence area; it also intends to coordinate with institutions, increase community participation, and strengthen organization and democratic participation.

The process of formulating the Full Size Project has begun and its strategies will be based on the lessons learned, on the needs of the target, and on rural electrification and environmental government policies.

The evaluation was carried out in order to offer inputs that strengthen the elements considered for a second phase and the systematization of the activities implemented in this “pilot phase” seeking more success opportunities for the Full Size Project.

For the external evaluation, 6 communities were selected. Four of them were subject of the project and two acted as “witnesses”, through comparisons carried out in 249 homes that were randomly selected. The rest of the information was obtained through interviews carried out in the institutional context, in municipalities of the three municipalities that constitute the Ixil region, in the observation committees and in the health centers of the Reyna zone.

Four (4) analysis groups were formed: Group A: homes in the Pa’l and Santa Clara communities that have Photovoltaic Lighting Systems (PLS); Group B: homes in the same communities, but without PLS’s; Group C: homes in the Chel and Las Flores communities, where a hydroelectrical microplant is being constructed and Group D (witness): homes in the communities of Juá and Chemal.

For the analysis of effects, Chi Square and non-parametric variance analysis (Kruskal-Wallis Test) tests were performed in order to compare the indicators of the four groups. The process analysis was performed through Interview Guides for different levels: involved institutions, municipalities and their corporations, the UNDP, the *Fundación Solar* and the officials of health stations in Uspantán (Reyna Zone).

The conditions of the Ixil region: high level of poverty, dispersion, exclusion and an important level of disintegration in the organization of the community pose the main

barriers for financing of development projects, fact that limits the possibility of increasing the quality of life of its inhabitants. The services area is a necessity that demands alternatives for generating income through employment and opportunity-generating activities for the inhabitants of this zone.

The concept and possibilities of renewable energy are still unknown by the inhabitants of the rural area, a fact that has generated incremental costs for empowering the beneficiaries through training programs aimed at reducing barriers for its implementation. Technical and economic feasibility studies were performed during the two years previous to the beginning of the project, including funding.

The UNDP through the Global Environmental Fund (GEF) assigned economic resources for financing the incremental costs of the project, fact that enables the introduction of renewable energy systems in 5 communities of the Chajul municipality and 5 communities of Uspantán, El Quiche. These communities were supported with community participation in order to achieve a comprehensive development that enables the attenuation of poverty and improvement of the quality of life of the beneficiaries through productive activities based on renewable energy.

During the implementation of the project there were important obstacles that hindered the normal execution process of the hydroelectrical microplant in Chel, which demands additional efforts and dialog and conflict-resolution strategies in order to overcome setbacks and reach its conclusion.

The findings indicate an adequate level of achievements in the implementation of the project. *Fundación Solar* has a good credibility in the institutional context. Reproducing this experience in other areas of the national territory is considered a strength. Local participation and leadership have been promoted, but existing organization has been preserved. Furthermore, personnel with significant experience in environmental and renewable energy issues, as well as a technical team whose objective has been to form local capacities for providing maintenance to the system have been involved in the project.

The participation of *Fundación Solar* has surpassed the field of renewable energy promoting local capacity in the EL Quiche region for the development of project pre-investment phases, which consist of a number of projects in negotiation stages and a project which has been carried out¹.

The Ixil region and the Reyna zone are eligible for this type of projects since a significant percentage of communities lie on river banks. Energy supply through the national grid is still impossible for many communities, fact that strengthens the viability of initiatives like the one *Fundación Solar* is supporting.

The use of clean energy directly impacts the decrease in the emission of greenhouses gases. The project demonstrated a decrease of up to 58% in the use of candles, kerosene and ocote in the communities that have PLS's, aspect which is interesting for organizations that support environmental protection driven initiatives.

¹ In the Chel community, municipality of Chajul, financing was obtained for a successful project of a rural telephone system.

The project had a positive effect on the reduction of CO₂ emissions, even when these were not measured. In the communities that have PLS's (Pa'l, Santa Clara and Chermal (witness community)) there was a 40% difference in the consumption of traditional fuels in comparison with the studied groups. This finding leads to the conclusion that the use of renewable energy is a viable alternative for the use of candles and kerosene lamps for lighting purposes, fact that has been of great interest for the cooperating institutions.

When the evaluation was being carried out, energy supply through the hydroelectrical microplant was not yet a reality, which was an obstacle for determining the extent to which the quality of life of the beneficiaries had been improved by generating an income.

The image that *Fundación Solar* transmits in the municipal context is reason enough to believe that the actions undertaken are perceived as an internal intervention that excludes the cooperating institutions. This implies the risk of setting too high expectations on *Fundación Solar* putting its credibility at risk.

The project has accomplished the elimination of financial barriers due to the level of participation of the different cooperating institutions that made the first phase of the project a reality. The main barriers were identified. Many of them are linked to the high exclusion levels of the communities in the area of influence, as well as to the negligible possibility of supplying electric energy to the area from the national grid. Currently the communities that have electrical energy supply suffer from a lack of efficiency of such supply.

The process implementation experience also increased the levels of community participation and enabled adequate mechanisms of interinstitutional coordination, the harmonization of strengths in the professional and technical fields and of community leadership, which was a success element for reducing the cost of implementing the project.

The *Fundación Solar* showed its experience in the field of renewable energy as well as in several aspects of local organization and participation. Nonetheless, the experience found in Chajul demonstrates that the coordination, organization and participation mechanisms have not been able yet to give the necessary consistency to local traditional leadership between the project, the local government and communities. At the regional and international levels, the *FUNDACIÓN SOLAR* proved to be a good resource provider.

The consulting firms think that the *Fundación Solar* can achieve a good impact the development of productive activities based on renewable energy in the areas of education and health, which would enable the extension of the current levels of coverage and attention.

The effect generated by the project regarding the strengthening of community organization statistically demonstrated that witness communities are different to the rest of the subject communities (average value of 1.76% against 34.59% in the subject communities), which leads to think that the project has strengthened the processes of community organization.

The level of management (as an effect indicator) was compared to in the four groups. It was found that groups A and B (49.38% and 47.92%) are statistically similar to each other with an alpha of 0.05 and different from groups C (86.67%) and D (25%). The influence can be explained by the fact that the actions taken in the execution of the project are conducted by a legally established association. Witness group D obtained the lowest value, which means that this is the poorest group in regards to management.

When measuring the participation of women, the communities of Pa'l and Santa Clara showed the best result (61.73%), which means that having lighting has enabled a participation of women between 18% and 20%, compared with households without PLS's in the communities intervenidas and the witness communities, which are similar to each other (41.67% and 43.33%, respectively).

The mitigation of climate change by displacement or substitution of traditional fuels measured by the decrease in the use of candle, kerosene and ocote enabled to find significant differences between the communities that have PLS's (76.54%) and the rest of the groups (Alfa = 0.05). This finding leads to the conclusion that there is a positive effect in favor of the mitigation of climate change, since group A had more than 30% substitution of traditional fuels in comparison with the rest of the groups (B = 18.75%, C = 46.47%, and D = 45.00%).

When statistically comparing the indicator analysis on "work of the committee" measured by the support level that it offers the beneficiaries and the opinion about them, differences of Alfa=0.05 were found among the communities of Chel and Las Flores (61.67%) of up to 22% less with respect to the other communities, which showed better results (an average of 84%). This could be due to the fact that in these communities work is done by the Asociación Chelense and the answers made reference to the work of the committee.

In regards to the environment an 28% decrease (average) in the use of candles, kerosene, ocote, and firewood was found in the communities of Pa'l and Santa Clara (group A) and the community of Juá (witness), which have PLS's. Statistically, these two groups (A and D) are similar to each other (76.54% and 75.00%, respectively Alfa=0.05) and different from groups B (52.08%) and C (43.33%), since there is no light in these households.

Recommendations were made in order to support projects of renewable energy for the education and health areas in order to increase coverage of literacy at the national level as well as health services through the availability of lighting for attending emergencies, strengthening the Cold Chain for guaranteeing the viability of biological elements (vaccines).

It was considered necessary to implement ethnologic methods of analysis for a better understanding of social dynamics. The experience in Chajul is an example for understanding the organizational and participation dynamics facing the issue of renewable energy. Two types of analysis were recommended: i) statistical studies exclusively for evaluating the effects of renewable energy and ii) an ethnological and qualitative study for enriching the social aspect.

Finally, agility in finalizing the project in the Chel community was recommended due to the risk of having the infrastructure in place without supplying the service. For this, *Fundación Solar* must try to establish a discussion forum with the Mayor of Chajul due to the existing differences between the foundation, the Mayor and the municipal corporation.

II. BACKGROUND

The “Microenterprise development by means of renewable energy in the *El Quiché* region”, PNUD-GUA/99/G35; GEF/FMAM project began in 1998 with the formulation of PDF block A, which identified a portfolio of projects and strategies for the development of renewable energy in the Zonapaz, according to operational program 6 of the GEF, which refers to the “Promotion of the adoption of renewable energy by removing barriers and reducing implementation costs”.

The project implementation formally began on July 1st, 2000 after the completion of a management phase, which includes a series of technical, pre-viability, and environmental studies, as well as negotiation in the political and financial contexts, both in national and international institutions. The strategies defined for the project are linked to national priorities and seek to support the consolidation of the peace process prior to the United Nations Framework Convention on Climate Change. It also supports the search for strategies that will enable access to electrification in remote rural communities and whose possibilities of being connected to the national electrification grid are too slim or too long-term.

Nevertheless, given the opportunity of having the possibility of constructing a local body for providing rural energy services, the project implementation strategy enables the interconnection with the national distribution grid and, if there is any remainder, offer electricity for other areas of this region through the mentioned grid.

Furthermore, innovative uses of energy are being fostered through the promotion of microenterprises, competitive and attractive rates for the times of day in which there are power remainders. Favoring the use during the hours of natural lighting would permit to offer special rates for night consumption exclusively for home use (lighting).

The project jointly established aims in the environmental context, which are designed to mitigate climate change assuming that the implementation of systems that enable the supply of clean energy significantly reduces carbon emissions through the displacement (total or partial) of traditional fuels (such as candles, ocote, etc.) or fossil fuels (diesel, kerosene).

For the implementation of this project the *Fundación Solar* has searched for interinstitutional coordination levels both at the local and the central levels as well as in the international context with the objective of transforming exhausted paradigms, which in some cases have only served as obstacles for the adoption of renewable energy in rural areas of the country, such as financial, institutional, and development barriers particularly in zones that have suffered violence and armed conflicts.

The interests of the project include: providing assistance in the development of microenterprises that provide renewable energy end services, through the use of renewable energy as a resource seeking the generation of income a new employment sources. At the same time, the initiatives constitute a way of satisfying global interests related to the mitigation of climate change. This is congruent with operational program 6 of the GEF, which consists in “promoting the adoption of renewable energy through the elimination of barriers and the reduction of implementation costs”.

The specific objectives of the project were designed to achieve the elimination of financial, institutional and development barriers through the implementation of innovative financial and organization schemes, through the strengthening of the knowledge on renewable energy themes due basically on the fact that there is a lack of awareness about the benefits of natural resources if there is an adequate and rational use of these resources.

Strengthening the local capacities in the area of influence of the project is a priority through the entire management process and based on a portfolio of projects to be implemented.

In this sense, the fact of bringing renewable energy to these excluded communities becomes a means of for strengthening the development processes, whose final objective is to increase the quality of life in poor and extremely poor towns in the area of influence through the implementation of productive activities supported by the use of electric energy.

Interinstitutional cooperation is achieved through this project with “strategic partners for development” who see the project as an alternative for aiding in the development of communities with few possibilities of having both mid and long term participation in the national distribution grid.

Community participation is one of the strategic lines of the project, basically because of the significant levels of geographic, politic and ethnic marginalization as well as the weaknesses in the organization and democratic participation systems.

The project has found spaces of interinstitutional cooperation between non-governmental organizations, which are justified due to the low level of current coverage of rural electrification, which is barely 17%.

During its implementation, the project has achieved the local promotion of the benefits that energy supply has through the adequate use of natural resources, which generates a strong interest in several communities of the Ixil region and especially in the municipality of San Juan Cotzal.

III. INTRODUCTION

The project “Microenterprise development by means of renewable energy in the *El Quiche* region” is in its final phase. In the first year of management the consolidation of the technical team was achieved², strategies and necessary actions for taking up again elements and activities that had been postponed were formulated in order to guarantee the fulfillment of objectives.

Included in the activities that are currently being carried out, the process of formulating the Full Size Project whose strategies are based on the learned lessons, on the needs of the communities subject of the project and on the rural electrification and environment official policies has already started.

In this sense the evaluation tries to provide tools for strengthening the elements considered for the second phase, elements that permit the evaluation of the effect and process indicators generated by the project as well as the strengths and weaknesses found and the contributions made by the institutions that participated in the Workshop for the implementation of lessons learned.

The evaluation of the project activities enabled the generation of insumos for identifying actions based on strategies that stem from the systematization of the activities implemented in this “pilot phase” so as to offer greater possibilities of success for the implementation of the Full Size Project.

In order to carry put the external evaluation 6 communities were identified. Four of them were inetervenidas with the project and two were “witnesses” in order to evaluate the quality of processes and their effect on the communities intervenidas through the comparisons made on 249 households, which constituted the scope of the household survey.

The internal evaluation reports prepared during the implementation of the project show results that were validated by the external evaluation, for which data capture instruments were prepared for the different types of stakeholders. These were then compared for the four groups of studies that were defined.

A statistical analysis was applied to the survey carried out in 249 households that were randomly selected. This analysis permitted the comparison of results obtained by the project in the communities intervenidas and the witness communities. The rest of the information was obtained through surveys at the institutional levels, municipal corporations (of the three municipalities of the Ixil region), observation committees and the officials of health stations in the Reyna zone. A descriptive analysis was applied to the results of these surveys.

The implementation of the project was based on aspects which were considered a priority for promoting the development of excluded communities in the region. Even when these communities have historically had their own organization systems, and support in organization and participation issues, in programs and projects for the consolidation of the peace process in the area of influence designed to mitigate the

² Mid-term project evaluation report

existing conditions of poverty, they have received an important support for strengthening these initiatives, key for the implementation of the project.

The project “Microenterprise development by means of renewable energy in the *El Quiche* region” is inscribed in a rather difficult context, which from its inception outlines an intervention aimed at understanding the real situation of the life conditions of the population of the selected communities. This is carried out through a socio-economical census. It is also aimed at preparing technical and economical feasibility studies which set the necessary conditions that ensure the success of the interventions.

With the objective of optimizing financial resources, *Fundación Solar* is able to integrate the support of institutions and organizations as “strategic allies for development” and with whom it exchanges the vision of the project generating in them the interest of contributing to mitigate compelling situations using renewable energy as a vehicle.

In this task, the valuable efforts of the beneficiary communities are added through the contribution of insumos and local materials, non-qualified manual labor and the active participation of leaders and authorities who bring credibility into the project before the rest of the inhabitants of the community.

Notwithstanding, the cultural characteristics of the subject population, the aftermath of the armed conflict the intention of the community leaders of being protagonists, local authorities at the municipal and departmental levels as well as political forces, set a singular scenario for the success of the project. These situations originate new challenges, new approach strategies and lessons that have to be taken into account for broadening the success expectations of *Fundación Solar* with the purpose of implementing similar experiences in the future in other areas of the country, within a full scale project.

These aspects were evaluated and considered by the evaluating firm, and are described in this report as general findings of the evaluation as well as the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. The results of the evaluation are divided in two research areas, which are considered a priority and which have been named Process evaluation and Effect indicator evaluation. These were specifically designed validated and approved for the project by the UNDP and *Fundación Solar*.

IV. OBJECTIVES

1. Project objectives

The project intends to assist in the elimination of financial, institutional, and project development barriers which hinder the adoption of renewable energy in rural areas, particularly in former conflict zones and focuses in aiding the development of microenterprises that provide renewable energy based services.

The specific objectives are aimed at removing the indicated barriers through:

- a. Promoting innovative schemes for funding and organization for supporting the development of productive energy services based on renewable energy.
- b. Contributing to the strengthening of knowledge and training in the field of renewable energy.
- c. Promoting the local capacity in El Quiché for the development of the phases of pre-investment through the concrete support to a project portfolio to be implemented.
- d. Eliminate the emissions of CO₂ generated by the use of traditional fuels as candles, kerosene and biomass fuels.

2. Objectives of the consulting process

- a. Evaluate the effects achieved by the project based on Appendixes A and B of the Terms of Reference of the evaluation with the objective of generating the design of the sample and prepare effect and process indicators, as well as the experimental design for the evaluation.
- b. Carry out an evaluation of the process done up to now through a descriptive analysis of the variables defined for the evaluation.
- c. Offer insumos for the identification of learned lessons.
- d. Identify, through a strengths and weaknesses analysis the elements that served as aids and the obstacles in the process of implementation of the project.

V. EVALUATION METHODOLOGY

The evaluation process was carried out after having implemented the five phases, through which the objectives for the evaluation and the expected outputs set forth in the Terms of Reference were reached. The implementation of each phase had a minimal variation with respect to the proposal established in the Technical Proposal presented by *Productividad y Desarrollo*. However, the results were satisfactory. The implementation of each phase is described as follows:

1. PHASE I (Appropriation phase)

This phase constituted the documental research in order to reach an appropriation context, both in the general scope of the project and in the process of implementation. For this, the following documents were available through the whole evaluation period:

- i. Project document
- ii. Technical cooperation agreement
- iii. Three reports of the auto evaluations
- iv. Relevant communications between UNDP and *Fundación Solar*
- v. 1999 and 2000 Work memoirs
- vi. CD with activities within ERIPAZ
- vii. PowerPoint report presentations (CD)

The process of documental review supported the definition of evaluation strategies with a closer examination of the elements of the project and putting the consultants in the real context of the project.

A part of this first phase was constituted by meetings between UNDP staff, the project management and *Fundación Solar*. Through these initial meetings, strategic lines of evaluation were set, reference materials were obtained and the methodology of evaluation of effects was discussed. This was supported by the UNDP.

2. PHASE II (Design phase)

After reviewing documents and the technical meetings between the UNDP, *Fundación Solar* and the evaluation consultants, a greater context is achieved in order to make the necessary adjustments to the Work Plan presented initially for the evaluation and elements for constructing the evaluation variables are obtained.

With the tools of the previous phase, the instruments for data capture are planned, prepared and designed. This activity includes the participation and contributions of the UNDP connection officials for determining indicators for defining evaluation variables and indicators to measure the effect. The instruments were revised and validated both by the UNDP and the project coordination of *Fundación Solar*.

This task was aided by a statistical analysis specialist, who was responsible for validating the survey instrument, preparing the electronic format for capturing the information obtained in the field.

The instruments were designed to permit an easy capture and tabulation before the statistical analysis. They were validated in the municipality of Nebaj. After this, pollsters were trained in polling techniques, ballot validation and data refining.

The experimental design for comparing indicators defined for subject communities and witness communities was based on comparisons through the Chi Square test, which was applied to the four study groups and to the group of subject communities and witness communities.

SAMPLE DESIGN. The sample design was based on evaluation design (observational study), in which communities intervenidas are compared with a witness. The information was collected in different target groups classified as follows:

- a. Community group: with which both the effect and the implementation process were evaluated. Within this group, we can find:

Community leaders and observation committees
 Households

According to the design of the evaluation, four subject communities intervenidas and two witness communities selected for their geographic similarities and population density were evaluated. The leaders were auxiliary mayor, committee presidents and members of the observation committees.

A random sample of 249 households was taken observing the following parameters:

- i. Alfa = 0.05
- ii. Beta = 0.20
- iii. Unknown variance
- iv. Minimal significant difference of 25%

- b. Health stations in the Reyna Zone: The officials in charge of the health stations were invited to attend a workshop in the municipality of Sacapulas, El Quiché, where the Interview guide was answered for the evaluation of the process of implementation (see Appendix 1).

- c. Project and participating institutions: With this target group the process of implementation was evaluated. Included in the institutions that were visited are: the Ministry of Environment and Natural Resources, Ministry of Energy and Mines, INDE, UNDP, *Fundación Solar*, and Proyecto Quiché, among other.

The sample was defined according to the following parameters:

Analysis group	Communities included	Number of households in group	Sample size
A: With PLS	Pa'l, Santa Clara	81	81
B: Without PLS	Pa'l, Santa Clara	80	50
C: With Micro-Hidro	Chel, Las Flores	382	60
Witness	Juá Chemal	200	60

Each group was selected according to the type of project that was implemented or to the particular situation of the community. Each group is described below:

Group	Description
A	Refers to total of homes where there is a PLS for the communities of Pa'l (40 to 80 households have a PLS) and Santa Clara (41 to 82 of households have a PLS)
B	Households in the communities of Pa'l and Santa Clara. In these communities, the solar panel project was implemented, although houses in this group are not benefited from the system (they are negotiating)
C	Conformed by households in the communities of Chel and Las Flores, where energy is being introduced through a microhydroelectrical plant (because of this, the project is not operating)
D	Households in the communities of Juá and Chemal, selected as witnesses for the analysis. In Juá, there are several homes that have solar panels, although they were not implemented by <i>Fundación Solar</i> .

3. PHASE III (Data collection phase)

In this phase the field work was done. This consisted in collecting data at different levels through interviews with members of the previously defined groups, as well as through consultants of the institutions in charge of the execution of the project, counterpart entities and beneficiaries.

Before carrying out the field work, survey ballots were validated in the municipality of Nebaj and necessary changes were made. Data collection was done by:

- a. Five Maya-speaking pollsters. Members of the Ixil ethnic group, who collected data in the 250 selected households.
- b. The Field Director, who collected data from the townships, the Ute's and with the officials of health centers in the Reyna Zone, and
- c. The evaluation coordinator, at the institutional level, Mayors and with the officials of health centers in the Reyna Zone, in the municipality of Uspantán, El Quiche.

The training process for the team of pollsters was crucial for understanding and managing the information collection instrument and the definition of the object population sample through the use of the random number table. After that, the information collection instrument was validated and the final instrument was refined. Finally, the field work was done according to plan.

Data collection covered different levels of work at the field level: the interview done at 249 households, the interview to observation committees, to the Chel Association and to the local committees in Jua and Chemal. Mayors of the three municipalities of the Ixil area, members of their municipalities, representatives of the cooperating institutions, the officials of health centers in the Reyna Zone and the authorities of the National Hospital of Uspantán, Quiche were also interviewed (in an activity carried out in Sacapulas). The interview guides were designed, revised and authorized by the UNDP and by the Project Coordination by *Fundación Solar*. After that, all institutional contacts were

made with the support of the Project Coordinator³ for the interviews with the counterparts (project stakeholders).

In the institutional context, this activity was carried out through guided interviews using a systematic guide (see Appendix 1). In the case of Mayors and Municipal Corporations, two modalities were used: a) the first one consisted in meeting with the Mayor and with members of the Municipal Corporation and b) meetings held with the Mayor for discussing specific issues that would clarify some aspects or study in depth other matters that were related with the performance of the project, interest in it and the will to support the initiatives of *Fundación Solar*.

For the interviews with the observation committees and Project Monitors, the Interview Ballot for Observation Committees was used (see Appendix 1). For this activity the focal group methodology was used, which is understood as the procedure of working with a group that has knowledge over a specific subject for two-hour time periods. These focal groups were used in each one of the visited communities. In the case of the communities intervenidas, the observation committee or the electric energy committee was interviewed. In the case of the witness communities, the community development committee was interviewed.

The activity with the officials of the health centers of the Reyna zone were carried out in two moments: a first moment for answering the Interview Guide (see Appendix 1), responded by officials of the communities of La Parroquia, Lancetillo, La Taña, Amajchel, and Unión 31 de Mayo. A second moment consisted of a Workshop-Forum organized with the authorities of the National Hospital of Uspantán, activity which was carried out in the municipality of Sacapulas, El Quiché (see Appendix 4, Participants)

4. Phase IV (Analysis Phase)

The field information obtained through the survey and interviews was revised and refined before measuring the variables. A structure was created for saving the information obtained at the 249 households. The rest was analyzed only in a descriptive manner, since this is what the number of ballots and interview guides permitted.

With the variables defined in the instrument for the survey applied at the households, the Effect Indicators were constructed, through grouping two or more variables, to which a numerical value was assigned. In order to simplify the analysis process, the adequate conditions were selected, that is, the response that enables a desirable situation. A value of “1” was assigned to this response, which could be a “yes”, a “no” or a desirable condition.

The data obtained in the field were processed as follows:

- a. Household Survey: The Ballot for Household Survey was used. The ballot was revised and corrected both by the UNDP and the Project Coordination of *Fundación Solar*. Then, it was validated in the field. A structure for saving the data was created for this ballot using the SAS software. The data was analyzed through a frequency

³ Mario Hernández, *Fundación Solar*

distribution, a comparison of means using the Chi Square test and a Kruskal-Wallis test, using SAS.

In order to do the comparison, process indicators were constructed (see Appendix 2) and adjusted assigning a value to each variable (see Appendix 3). These values were analyzed for establishing differences both for each group (A, B, C, and D) and for the groups of subject communities (Groups A, B, C, and D) and witness communities (Group D).

- b. For all the other sectors evaluated interview Guides were used and analyzed in a descriptive manner.

The response that reflected the least desirable condition was assigned a value of “0” in the same way as in the previous section. With these values an “indicator value interval” was established, that is, the lowest and the highest value, for example: 0-4, which means that a value of 0 is the most critical condition and a value of 4 is the most desirable condition.

5. Phase V (Result definition phase)

This final phase of the consulting process consisted of the preparation of the Preliminary Result Report (Final Report Draft) for revision and comments by the UNDP and *Fundación Solar* before the presentation of the final version based on the observations and comments.

In order to reach some results, the general findings of the evaluation are posed. These findings reflect the levels of perception of the project, as well as the aspects that the evaluation of the project includes.

Additionally, an evaluation of the effects that have been reached to this date was made through the measurement of indicators proposed for the evaluation of effects. From the indicators, general conclusions on the real situation of the project and the impact that it has achieved in the area of influence are reached.

6. Phase VI (SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis)

Based on the field findings, as well as on contributions made by institutions, the results were gradually systematized in order to determine which have facilitated the process of implementation and which have hindered it.

This systematization enabled the gradual grouping of aspects that have served as catalysts in strengths and opportunities as well as those aspects which have hindered the implementation, defined as weaknesses and threats.

The SWOT analysis's basically referred to the evaluation of the process, in which relevant points obtained from the information contributed by institutions, community leaders, observation committees and other key stakeholders of the process are highlighted.

Support of *Fundación Solar*

In order to obtain the necessary information, the *Fundación Solar* supported the logistics for establishing contacts and interviews, as well as defining the participation of the officials of the health centers of the Reyna zone in Uspantán,

For this, the *Fundación Solar* sent written notices to each participating institution and informed the community leaders through the organization of a conflict resolution workshop in San Juan Cotzal where representatives of the subject communities were present.

All the necessary information such as digital photographs, reports, appendixes, previous studies, video presentations, etc. were made available for the consulting firm with the objective of having all the necessary tools for carrying out the evaluation.

Contribution to the Learned Lessons Workshop

The report groups conclusive elements both for the effect evaluation and for the project implementation evaluation. In addition, conclusions and recommendations were formulated as a basis for defining key aspects that supported the generation of learned lessons during a workshop prepared by the UNDP before the implementation of a follow-up phase named Full Size Project.

VI. EVALUATION RESULTS

This evaluation has its origin in the analysis of the objectives set by the project, as well as in the achievements reached, the positioning of *Fundación Solar* in the area of influence and with the direct stakeholders of the project.

For the evaluation, specific instruments for the interview were designed and applied to cooperating institutions and organizations, leaders, observation committees, municipal authorities and officials from the health centers in the Reyna zone.

About the findings, it can be said that the project has had a variety of analysis viewpoints, which reflect successes and errors (these last are due to factors that go beyond control of the *Fundación Solar*).

In the following paragraphs some aspects about the evaluation findings are mentioned. These aspects are considered relevant by the evaluating firm and they are grouped by source as follows:

1. Main findings

In order to define the evaluation findings, a reference is made principally to the elements that define the evaluation of the implementation process. Within this working context instruments were defined for collecting data, which was done through direct interviews (in the case of institutions), focus groups (in the case of observation committees), and brainstorming (in the case of the officials of health centers of the Reyna zone and municipal corporations).

Additionally, the documentation that the *Fundación Solar* made available for the consulting firm enabled the definition of the main aspects of the process. The documental information obtained through interviews and field work lead to the principal findings, which express the opinion of the team of external evaluators with the purpose of contributing to define the strategies that permit a better operation of the Full Size Project (second phase of implementation).

a. External opinion of the consulting firm about the process

The project is embedded in a context of opportunities based on the conditions in the Ixil region, characterized by high levels of poverty, dispersion, exclusion and a significant degree of community organization disintegration, even when it has been an aspect deeply rooted in the Ixil culture, derived from the armed conflict and the need to survive.

These conditions establish the main financial barriers for development projects, which significantly limits the possibility of raising the current quality of life, measured as the satisfaction of basic needs.

The area of services is the one of such needs, which include having alternatives for generating income through productive activities that generate employment and opportunities for the inhabitants.

Renewable energy, generally unknown by the inhabitants of the area of influence of the project, offers these opportunities with the added value of mitigating climate change through the introduction of clean energies capable of removing greenhouse gases emissions, product of using fossil and biomass fuels.

This task, in the technical and economic feasibility studies implemented by the *Fundación Solar* (which took about two years and include the process of fund management) determines the need of investing on the main foundations of the development:

- Forming Cuadros Gerenciales as a local resource owned by the beneficiary communities.
- The empowerment of the basic principles of renewable energy
- Strengthening community organization, based on a participative democracy principle
- Community participation as a counterpart contribution which reaches significant levels of the total percent value of the participation of cooperating entities (more than 16% of the total amount invested).

Fundación Solar, with the support of the Global Environmental Fund, GEF was able to obtain resources for financing the incremental costs of the project. This makes the implementation of renewable energy systems a success in five communities of the municipality of Chajul, Quiché and six communities of the Reyna zone, Uspantán.

Through this investment the increase in community participation is a reality. This is a product of the consolidation of organization at various levels of implementation that go from the Observation Committee to the creation of an association⁴ legally registered in the Superintendencia de Administración Tributaria.

It is the opinion of the evaluating mission that *Fundación Solar* achieves important execution levels, which means that the process of implementation is well-planned and organized, as well as backed by professional and technical human resources with high capacity and who work as a multidisciplinary team.

In the development of the work some aspects inherent to the popular culture of the communities which are victim of the armed conflict are beyond the control of *Fundación Solar*. This originates a culture of confrontation, high levels of sensibility, certain degree of distrust for the intervention of foreign agents. However, the conviction of the fact that only through integral development will permit them to surmount the existing poverty levels through opportunities for elevating the quality of life is also present.

⁴ Asociación Micro Eléctrica Chelense, Aldea Chel, San Gaspar Chajul

This “frailty” found in the area generates significant obstacles that hinder the process of implementation of the project in Chel, situation which is almost solved, but that demands additional efforts and communication and conflict resolution strategies, trying with this not to affect the principles of autonomy of the municipality, as well as not causing divisions in the community organization.

As a conclusion, the findings suggest a good level of achievements in the process of implementation, with the usual clarification that the opinions expressed by the different instances which were interviewed must be taken into account as valuable elements in the search for positive lessons in order to improve processes in a second phase.

b. Opinion of Mayors and municipal corporations

The general vision of mayors of the Ixil area is that *Fundación Solar* carries out a good technical work related with renewable energy projects. However, in the political context, it has had to face some difficulty that go beyond the merely technical aspects. Such is the case of what is currently happening between *Fundación Solar* and the Mayor of Chajul, which has an impact on interinstitutional relations and the coordination of the processes of implementation. The existence of these limitations hinders the physical progress of the work. The Mayor of Cotzal has that solidarity in mind, but he is also proactive in his interest for promoting the search for prompt solutions for continuing to work in the Ixil area.

The municipality of Chajul has always had the interest and the will of coordinating and supporting the efforts of the different institutions and organizations that work in Chajul. Specifically, in the case of the project that *Fundación Solar* is carrying out, the Mayor mentions the existence of coordination problems, specially with the local technical team, responsible for the managing the actions at a local level. Part of the communication problems were caused by misunderstandings in a study for the construction of a road between the communities of Jua and Chel done by the municipality of Chajul.

Fundación Solar offered support for interpreting some technical elements of the study, since this road is necessary for transporting materials and equipment to the village in order to finish the project. According to the mayor’s perception, the form of interpretation and the communication in this matter created confusion among the population giving room for thinking that the study was completely useless.

The construction of the road is essential since, according to the mayor’s perception, some people have complained of having back problems caused by the effort made for carrying the poles and cable bobbins for the project. Additionally, there is some uneasiness because the transportation of materials had no economic retribution, which originated the proposal of having some kind of privilege in the fees (temporal waivers) for the people that participated in the transportation of these materials once the project is operating. However, *Fundación Solar* indicated the contribution in the form of unqualified manual labor financed the purchase of supplies for the house connections (electrical plugs, switches, cable, etc.).

The intervention of the Department authorities (the Department Governor, the representative of the official party and the former mayor of Chajul) caused a political misunderstanding since this subject is quite delicate in the area, especially in the municipalities of Nebaj and Chajul because the mayors are from opposing parties.

The mayor of Nebaj has showed solidarity with the statements of the mayor of Chajul, trying with this not to go against the principles of ERIPAZ. They both think that there are mechanisms to carry out the project, which would be subject to establishing a dialog in which key themes must be addressed and taken care of both by *Fundación Solar* and the municipality of Chajul.

Some of the conditions for resuming the dialog (that will even aid the participation in ERIPAZ in the implementation of the Full Size Project) proposed by the mayor of Chajul are:

- i. Change the technical and professional staff assigned to the Ixil area by *Fundación Solar* there is the perception of being an arbitrary imposition, which does not mean that they abandon the *Fundación*.
- ii. Establish an adequate coordination system, starting with the coordination between the mayor and the Executive Director of *Fundación Solar*. Up to now, the mayor has only had contact with the local technical team and has not met the Director, thus demanding that there be communication at this level.
- iii. Limit the work of *Fundación Solar* strictly to the renewable energy field, which implies mechanisms of interinstitutional coordination. *Fundación Solar* must limit its participation in activities of a political nature, such as the participation of the Governor, the Representative and the former Mayor. Any comment that involves local authorities must first reach a consensus with the municipality of Chajul.
- iv. *Fundación Solar* should avoid being influenced by any person with a political party agenda in the Department and the municipality, since it is known that there are persons who are interested in trying to get hold of these support spaces in order to proselytize.
- v. Some form of retribution for those that participated in the transportation of materials should be considered when the project of the micro hydroelectrical plant is operating. This could be in the form of fee waivers for a period of time.

Fundación Solar started holding conversations with the municipal corporation of Nebaj and Cotzal approximately four years ago in order to start some renewable energy projects in these municipalities. Up to now, no progress has been made, even when the communities that have the potential for replicating the experience carried out in Chajul have been identified. These are:

Communities with potential for developing Micro-hydroelectric plant projects

Municipality	Community	Families
SANTA MARIA NEBAJ	Sumalito	100
	Trapichitos	150
	Vatz Chocolá	80
	Ixtupil	95
	Santa Marta	200
	Las Pilas	50
SAN JUAN COTZAL	Villa Hortensia II	200
	Pamaxán	300
	Xetupul I (150) y II (150)	300
	San Marcos, Cumlá	150
SAN GASPAR CHAJUL	Ilom	1,200
	Xaxmoxan	40
	Estrella Polar	100
	Amajchel	1,000

From ERIPAZ's viewpoint there have also been a couple of meetings with *Fundación Solar*, which were held a long time ago. Up to this date, no formal meeting has been resumed, except for an occasional informal visit by the staff of *Fundación Solar*.

The mayor of Nebaj considers that the mission of *Fundación Solar* is not completely clear and therefore there is no understanding yet of the goal it has in the Ixil area. The president of ERIPAZ perceives that sometimes the figure of this organization is used to secure funds and not to support the coordination processes in the area, which strengthens the institutions more than it does the municipalities.

In the meetings held previously, an interest for strengthening the training processes has been manifested, even though no training process has been carried out up to this date within the institutional context of ERIPAZ. Nevertheless, the municipalities have manifested that there is great interest in training, especially in subjects related with the Rural Electrification Law, aspects related to the protection of the environment, and renewable energy.

There is a great interest in implementing an integral project that offers possibilities to the communities of the Ixil area and which considers within the development initiatives the use of electric energy in the three municipalities, since many communities of the Ixil area have enough hydrological natural resources.

Evidence analysis

The opinion of the consulting firm is that the following issues can be considered for establishing a technical discussion space based on the evidence obtained with the mayors and municipal corporations:

→ First issue: The technical aspects of *Fundación Solar*

The three mayors and the municipal corporation recognize that the technical capacity of *Fundación Solar* for the technical aspects of the implementation of renewable energy projects is unquestionable. In fact, in the projects that are currently under way in the communities of the municipality of Chajul with Photovoltaic Lighting Systems, the mayors state that families are being in fact benefited in the sense of having electric lighting for some house chores by night, decreasing the cost by not purchasing candles or gas for their lamps, as well as the investment for health prevention. In this sense, it seems that there is no objection for the technical field work that *Fundación Solar* does.

→ Second issue: Relationship and substance

“Relationship” is understood as the processes for reaching a satisfactory agreement for all parties and “substance” is understood as the production of options for satisfying the interests of each party.

The opinion of the consulting firm is that this issue raises certain concerns at least for the mayor of Chajul and Nebaj in the sense the “relationship” between *Fundación Solar* and the municipal governments of these municipalities has not been able to be sufficiently strong for having a large scale renewable energy project which benefits the three municipalities. When the president of ERIPAZ (Ixil Regional Meeting for Peace), who is currently the mayor of Nebaj, poses the need for dialog in this regard, it is highly probable that certain uncertainty is being reflected on the continuation of the dialog efforts for strengthening the “relationship” followed by the “substance”, which will imply the identification and the setting of priorities of future projects with the *Fundación*.

The municipal corporation of Cotzal poses the need for promptly reinstalling the cooperation process with *Fundación Solar* since a visit that it did to two potential hydrological resource is mentioned. However, after some time there has been no follow-up.

It is important to recognize that the “relationship” step is essential and determining for the improvement of the relationship between ERIPAZ, the mayors of municipal governments in the Ixil area and *Fundación Solar*. At least for the president of ERIPAZ, solidarity with the members of this organization is crucial and considered the necessary for the solution of problems that could be affecting any of the members of ERIPAZ.

Probably, *Fundación Solar* has the intention of going along with the implementation of projects at a community level, but it also has to take into account that financial institutions not always clearly understand the needs of this type of projects. This would make the management work of the *Fundación* go uphill and on the other hand, this aspect is not always understood or interpreted in the same way locally. Thus the need for maintaining and strengthening the “relationship” between the parties involved.

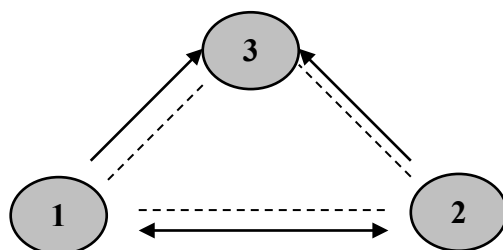
→ Third issue: Coordination

The opinion of the consulting firm is that this aspect is probably one of the weakest among the parties involved in the project. According to the evidence found, there are

two versions of the almost inexistent coordination in the case of the mayor of Chajul and *Fundación Solar*. On the one hand, there is the opinion that the mayor has not expressed sufficient interest for reaching an adequate level of coordination since *Fundación Solar* has sent invitations for different events and the mayor has not responded and has not participated in them. The situation of the mayors of Nebaj and Cotzal regarding the invitations made by *Fundación Solar* has been different, since when they have not been able to attend, they have at least sent representatives.

For the mayor of Chajul the relationship between the *Fundación* and the municipality was acceptable, but the coming to a standstill of the coordination process started when the staff of *FUNDACIÓN SOLAR* made a comment in the community of Chel in regards to a technical study for opening the road from Juá to Chel, when it was not the place of *FUNDACIÓN SOLAR* to give its opinion.

Currently in Guatemala the efforts made for improving the conditions of the population that lives in rural areas are going through an interesting period in which the aspects of decentralization and coordinated work with the municipal governments become relevant. The consulting firm thinks that new schemes for approaching development are a well-known subject for *FUNDACIÓN SOLAR* and which it solidly manages. In practice, a logical and updated coordination process in support of decentralization should be seen under the following scheme:



Where:

- 1 represents the level of support institutions and NGO's
- 2 represents the level of municipal governments, and
- 3 represents the community context

Therefore, in order to go along with local processes the relationship between institutions/NGO's and the municipal government are fundamental for constructing local capacities in an environment of democracy strengthening (the relationship between continuous lines).

The dotted lines represent the process of communication flow, which would be given at every level of action. The previous scheme could then not only strengthen more capacities for the sustainability of the ongoing projects, but also the democratic coexistence and the improvement of quality of life of the population.

Based on the evidence found, the situation that the *FUNDACIÓN SOLAR* and the municipality of Chajul are currently going through in terms of coordination, it would seem that the relationship has been centered more on the coordination framework between the *FUNDACIÓN SOLAR* and the communities on the one side and between

the municipalities and the communities on the other, leaving to one side the action and commitment with the municipal government of the *FUNDACIÓN SOLAR*, whatever may be the case. In this sense, the probability of strengthening local capacities and sustainability of the renewable energy projects is meager.

→ Fourth issue: the political and the politics

The consulting firm can say that, based on previous experiences, this type of situations (like the coordination between the municipality of Chajul and *FUNDACIÓN SOLAR*) generally give enough margin for people with other objectives to use them as political tools. In order to avoid this situation (which is normal, up to a certain point), the parties need to discuss and reach consensus that enables them to maintain the main objective, which is to serve in a better way the population that demands this type of projects. Facing the next elections in Guatemala, the consulting firm considers that it is not healthy that this type of situations are still occurring since at the end of the day, the population of the communities in the area of influence of the project are the ones who result affected.

c. Institutional Context

Since its inception, the project intended to promote innovative schemes for financing and organizing the development of energy services, which was tried to be determined through the interviews held with the different institutions involved with the project.

On the basis of this statement, it can be said that the project manages to successfully articulate the interinstitutional participation and cooperation, which includes from government institutions to external cooperation organizations, municipalities and communities. This element constitutes a success factor since it helps achieve a good level of support in terms of investment.

The key element, which in turn becomes common factor within the institutional context, is the credibility that *FUNDACIÓN SOLAR* has. Moreover there has been a good level of coordination and management by the authorities of *FUNDACIÓN SOLAR* and the instances involved.

The institutional work order, the objectives and goals in the field of renewable energies make it interesting for the institutions to put their stakes in the initiatives of *FUNDACIÓN SOLAR* since it fits in with the development policies of the country and of the external cooperation.

In this way a good level of implementation which goes beyond the expectations set in the project document is achieved. The project document intended to execute a small scale project but it reached the medium scale category because of the number of investments and scope that is achieved in this first phase.

Most of the institutions visited believe in the viability of implementation of a full size project. The experience in the Ixil area convinces several institutions of the technical feasibility for carrying it out. At the same time, there is the potential of natural resources for replicating the experience in other areas.

Fundación Solar manages to get near to other institutions with the objective of making the support initiatives for the project known. This strategic activity achieves a good level of articulation and all financial barriers for the investment are overcome, specifically for the project “Microenterprise development by means of renewable energy in the *El Quiche* region”.

The INDE, for example, in its institutional work order considers a support line for rural electrification, which opened a space for financing the installation of the whole grid of electrical lines, including home connection and the installation of switches and electrical plugs.

In this achievement the community plays a very important role since it makes a significant contribution to the project, which consists of the manual labor, materials present in the community and a smaller amount of money contributions for purchasing necessary accessories for the home connections.

The level of relationship between the visited institutions and the *FUNDACIÓN SOLAR* is given in the context of the coordination for the implementation of the project, achieving in most cases support for financing the executions.

Most of the institutions are acquainted with the *FUNDACIÓN SOLAR* since its inception, which is basically so because of the experience and work trajectory of its technical and operative staff. This opens important paths of interinstitutional cooperation based on elements of: interest, consistency with the institutional policies and the profile of work of the Fundación, the innovative aspects of the project, etc. The Quiché program stated that it does not fully know the *FUNDACIÓN SOLAR*, since the existing link is limited to the support offered.

The proximity of *FUNDACIÓN SOLAR* with the visited institutions has had the intention of strengthening the project through the management of technical and financial cooperation, which marked the success in the consolidation of this phase as well as generating an interest of maintaining the cooperation for a longer second phase.

The visited institutions have within their line of work the support to activities that tend to aid in the protection and preservation of the environment and in rural development projects. Such is the case of FIS, FONAPAZ, the European Union, AID, etc. Some of these support electrification processes, which is the case of the Ministry of Energy and Mines through the Rural Electrification Program and the National Institute for Electrification (INDE).

The initiatives of the *FUNDACIÓN SOLAR* regarding renewable energy are known by the interviewed institutions. All of these initiatives were qualified as valuable, innovative and of interest for the development policies. In this sense, the role of the Fundación was considered positive since it has tried to reach remote communities with little access to development due to the high levels of exclusion that they suffer.

The Quiché Project considers that there are aspects that could strengthen the institutional work of the *FUNDACIÓN SOLAR*. These aspects include maintaining the solid levels of interinstitutional relationship, as well as putting more interest in the support activities. Concretely, the *FUNDACIÓN SOLAR* requested support in the form

of construction materials, whose invoices are ready for purchase and shipping to their destination, but no such request has been made causing that this operation be at risk of not being completed.

The actions of the *FUNDACIÓN SOLAR* were considered consistent with national policies which are oriented as strategic lines for promoting development using energy as a means. Moreover, it is important to observe that the actions take into account an interest in mitigating the environmental problem.

The Ministry of the Environment and Natural Resources, the INDE and the Ministry of Energy and Mines consider that these activities are compatible with the energy and environment protection policies, fact that opens spaces for the technical and financial cooperation for the implementation of the Full Size Project. This intends to increase the energy supply in the rural context in order to achieve a higher level of social, economic, health and community participation, which allows to infer that the initiatives of the *FUNDACIÓN SOLAR* in development projects based on the use of renewable energies have generated an interest of the institutions and other external cooperation organizations for supporting the capacity of replication of this type of projects in similar areas.

At the local level, the Co-director of the Ixil Project mentioned that FONAPAZ contributed by financing the *FUNDACIÓN SOLAR* for the purchase of solar panels in Santa Clara, Pa'l and Amajchel. On the other hand, the purchase of the turbine and the ducts that will be used in the micro-hydroelectric plant in Chel, Las Flores and Xesai was supported with funds of the aid program.

During the interview, the Co-director stated that there is concern because the time has gone by and the micro-hydroelectrical plant project is not a reality yet. In the local context, there is information related with the problems that have arisen between the *FUNDACIÓN SOLAR* and the municipality of Chajul.

The opinion expressed at the local level within the institutional context, reinforces the importance that establishing mechanisms or interinstitutional coordination with the higher management of the *FUNDACIÓN SOLAR* has in order to review the agreements made for supporting the area. In this way, credibility will be an important stronghold for strengthening relationships.

d. MONITORS, LEADERS AND OBSERVATION COMMITTEE

This consultation was carried out through a interview ballot, which was answered collectively by the Committee. Each interview was applied to the respective Committee of each community for the following elements:

- Socio-economic and cultural
- Organizational
- Environmental
- Photovoltaic lighting (technical)
- Photovoltaic lighting (financial)
- Micro-hydroelectric plant (technical)

- Micro-hydroelectric plant (financial)

The evaluated communities are the following: Pa'l and Santa Clara, “including Groups A and B”. In these communities a Photovoltaic Lighting Project was implemented. Las Flores and Chel: pertain to Group C, communities benefited from the construction of a micro-hydroelectrical plant, and Juá and Chemal: Group D, “witness communities”.

For an easy comprehension, the following table is included. In this table, the results obtained in the interview are presented, The interview was carried out under the methodology of focus groups, with the representatives of the Observation committees, as well as the Asociación Chelense and the Development Committees of the witness communities.

**COMAPRATIVE TABLE OF THE FOCUS GROUPS RESULTS WITH
THE OBSERVATION COMMITTEES AND MONITORS IN THE EVALUATED COMMUNITIES⁵**

VARIABLE DEFINED BY COMPONENT	SUBJECT COMMUNITIES WITH PLS (A y B)	SUBJECT COMMUNITIES WITH MICRO-HYDROELECTRICAL (C)	WITNESS COMMUNITIES** (D)
SOCIAL AND CULTURAL COMPONENT			
New activities in the community, after the project	Cultural and recreational activities, organization has been strengthened, communication among neighbors has increased and night school has been extended.	No lighting yet.	In Jua there is PLS in some houses, cultural and recreational activities has been strengthened. In Chelal there is no project and no new activities.
Changes in customs and traditions of the community (after the project)	The organization has had previous strengthening, there have been changes in customs due to the project	The project has not concluded	Only in Juá, even though they are few changes.
ORGANIZATIONAL COMPONENTS			
Decision-making within the Committee	Made by all the Committee members, consensus is reached and agreements are registered	Made jointly by the Committee members, decisions are made jointly after reaching consensus.	Joint decisions are made by all committee members. Consensus is strived for.
Activities for conducting the project	There are specific work commissions	There are specific work commissions	The creation of commissions is strived for
Obstacle for carrying out the work	People do not meet, they ask for things, but they do not contribute. There have been little follow-up and guidance by <i>FUNDACIÓN SOLAR</i>	People do not meet, they ask for things, but they do not contribute. There has been discomfort in some members	There are almost no meetings between the committee members and the community members
Motivation for maintaining the project	They have tried to keep in contact with <i>FUNDACIÓN SOLAR</i> . Commissions have also been sent to the capital city.	In many instances there has been no need for asking. In other instances, <i>FUNDACIÓN SOLAR</i> has been questioned	The committee is being kept active in informing the community.
Organization of the work	There are permanent work commissions which meet monthly	There are permanent work commissions which meet monthly as needed	There are permanent work commissions which meet monthly
New projects accomplished by the Committee, type, granting and results achieved	Only one school project was approved in Pa'l, none in Santa Clara	In Las Flores only one road project is approved, in Chel there are two more projects approved	In Chelal two are approved (school and health center) and one in negotiation (road), in Juá, part of the financing for a road project has been granted
Needs detected by the Committee for improving its work	Training and supply of materials, travel expenses are also needed	Financial training and support of the municipality and of the community	Obtain training for the committee and the leaders
Necessary activities for strengthening the organization and its operation	Training and follow-up	Training in community organization and management	Strengthen communication with other existing committees

⁵ In the communities of Pa'l, Santa Clara, and Las Flores, Committee members were interviewed; in the village of Chel, members of the Asociación Chelense were interviewed and in the witness communities the Development Committee members were interviewed.

VARIABLE DEFINED BY COMPONENT	SUBJECT COMMUNITIES WITH PLS (A y B)	SUBJECT COMMUNITIES WITH MICRO-HYDROELECTRICAL (C)	WITNESS COMMUNITIES** (D)
ENVIRONMENTAL COMPONENT			
Drinking water, source and maintenance	Only in Pa'l, it is spring water and maintenance is given to the source. In Santa Clara it is well water.	In both communities there is drinking water. The source is a well. They try to give maintenance to the source.	In both communities there is drinking water. In Juá there is also a well. Maintenance is given to the source.
TECHNICAL COMPONENT OF PHOTOVOLTAIC LIGHTING			
There is a committee responsible for the PLS	It exists in both communities	DOES NOT APPLY	Only in Juá there is a committee for the maintenance of the PLS
There are technical monitors responsible for the PLS in the community	Some of the committee members have been selected and received training	DOES NOT APPLY	In the community of Juá there are technicians, but they are not monitors
Do monitors detect and correct system failures?	Yes, it is part of their responsibility	DOES NOT APPLY	If failures are detected they are repaired (if there is enough money or if it is easy)
Average monthly failures	Generally between 2 and 4	DOES NOT APPLY	More than 15 per month
Average monthly claims, guarantees or corrections	Not more than 3	DOES NOT APPLY	Between 4 and 5 (average)
Facility for finding answers in the local store of the community	Not found easily	DOES NOT APPLY	There is no such store
Quality of attention received at the store	In Pa'l it is not very good, in Santa Clara it is good	DOES NOT APPLY	There is no such store
Activities for taking care of the PLS	Generally, regular cleaning, eventually pieces are changed,	DOES NOT APPLY	Only check-ups are made
FINANCIAL COMPONENT OF PHOTOVOLTAIC LIGHTING			
Problems for collecting fees	Payments are not made on time. There is economical hardship	DOES NOT APPLY	Fees have not been established
Solutions implemented for payment of fees	Later date is given for payment	DOES NOT APPLY	DOES NOT APPLY
Opening of a bank account	There is an account in both communities	DOES NOT APPLY	DOES NOT APPLY
Frequency of deposits	Monthly in Pa'l, In Santa Clara is made every three months (average)	DOES NOT APPLY	DOES NOT APPLY
Problems for the user for payment of fees	Payments are not made on time or only partial payments are made	DOES NOT APPLY	DOES NOT APPLY
Causes of the problem	Family income is not enough and there are no accountants	DOES NOT APPLY	DOES NOT APPLY
Money saving system	Money is deposited in bank	DOES NOT APPLY	DOES NOT APPLY
Indicated advantages of having a bank account	Income is controlled and confidence is generated among the community	DOES NOT APPLY	DOES NOT APPLY

VARIABLE DEFINED	SUBJECT COMMUNITIES WITH PLS	SUBJECT COMMUNITIES WITH MICRO-	WITNESS COMMUNITIES**
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BY COMPONENT	(A y B)	HYDROELECTRICAL (C)	(D)
Control of income	Payment receipts are given out and records are kept	DOES NOT APPLY	DOES NOT APPLY
Understanding of importance of payment of fees by the users	Users have understood that it is important for the project	DOES NOT APPLY	DOES NOT APPLY
Bank credits granted up to now	None to this date	DOES NOT APPLY	DOES NOT APPLY
Destiny of the funds (fees)	For purchasing supplies	DOES NOT APPLY	DOES NOT APPLY
Response of users for paying credits	There have been late payments but users are interested in paying fees	DOES NOT APPLY	DOES NOT APPLY
TECHNICAL COMPONENT MICROHYDROELECTRICAL PLANT			
Activities of the Committee for generating awareness and confidence in users	DOES NOT APPLY	Training for groups of women and men. It is done in community meetings	DOES NOT APPLY
FINANCIAL COMPONENT MICROHYDROELECTRICAL PLANT			
Participation of Committee for managing financial resources	DOES NOT APPLY	Committee has actively participated	DOES NOT APPLY
Problems found for securing funds	DOES NOT APPLY	Budget problems for the financial sources	DOES NOT APPLY
Procurement of additional funding	DOES NOT APPLY	Only in Las Flores, not in Chel	DOES NOT APPLY
Financial source contacted	DOES NOT APPLY	Municipality and some NGO's	DOES NOT APPLY
Deficiencies for managing these funds	DOES NOT APPLY	None found	DOES NOT APPLY
Mechanisms for eliminating deficiencies	DOES NOT APPLY	It has not been necessary. In some cases, counseling is being sought	DOES NOT APPLY
Destiny for the funds	DOES NOT APPLY	For purchasing materials, extending the coverage is being considered	DOES NOT APPLY
Form of granting the funds	DOES NOT APPLY	When contributions have been obtained, they have been in the form of donations	DOES NOT APPLY
A loan for concluding the renewable energy project is being negotiated	DOES NOT APPLY	No, because it is considered that the resources are already in place	DOES NOT APPLY
			DOES NOT APPLY

** In the village of Juá household that have a photovoltaic lighting system were found, but it was not implemented by *Fundación Solar*

e. OFFICIALS OF THE HEALTH CENTERS, REYNA ZONE

In the meeting held with the health officials in Uspantán, Quiché opinions regarding the evaluation process were given. These are valuable for the purposes of *FUNDACIÓN SOLAR*, which are to generate elements for learned lessons.

It was demonstrated that there is an interest in using renewable energy for purposes other than lighting. Currently, refrigeration and lighting are being used independently from each other. There is sympathy from the health authorities since the setting up of a cold chain for preserving biological products in the area has been supported. There is a person that has a good level of knowledge of the photovoltaic system, which has ensured the maintenance and operation of the solar panels.

The proximity and interinstitutional coordination between the *FUNDACIÓN SOLAR* and the Ministry of Public Health and Social Assistance is given through the link and participation of the following instances: municipality of Uspantán, the involved communities, the National Hospital, the Area authorities, and the JHPIEGO service firm.

There have been some meetings between the health authorities in the area with the objective of improving some aspects of the Cadena de Frío, since in some places there are no deep cycle batteries, and the ones that are currently being used do not have an adequate energy output for keeping a low temperature and protect the biological products (they are truck batteries).

The interviewed health authorities consider that there have been important accomplishments in the implementation of the project, since an improvement of attention has been achieved, especially in the case of emergencies during night hours, as well as an increase in the protection and maintenance of biological products (vaccines).

Even when the photovoltaic lighting project was implemented, the need for increasing lighting has been mentioned both for the new health center that has just been constructed and in the existing ones since the energy generated is used mainly for the Cadena de frío. The project is considered positive and very helpful. Having implemented it in these zones has enabled having a broader view on the use of natural resources for the production of renewable energy.

The project has been positively evaluated by users since activities that enable its adequate operation and maintenance have been implemented. In this implementation, the Health Committee, the Hospital, the Area Authorities, staff from the health centers and the community take part.

Besides being used for the cadena de frío, energy is also used for lighting, which has enabled the extension of attention services, both for emergencies and for members of neighboring communities. An additional benefit to lighting, it was mentioned that being able to use a radio encourages work by providing something as essential as the news and musical entertainment.

The technical assistance and training offered by the *FUNDACIÓN SOLAR* has been less in this area than in the communities of Chajul, where longer-lasting processes have been implemented. Even though there is a signed agreement several points have not been met, among them: the implementation of a radio communication station and its mobile units, which would facilitate to answer emergencies in case the system fails, even in medical emergency cases in some communities of the influence area and other areas close to it.

The quality of service that the system provides is considered good, even when the need for considering its extension was mentioned with the purpose of guaranteeing a better service. The maintenance and repair are the responsibility of the Uspantán Hospital, as well as of the API (health care provider -PSS-). When it is needed to invest in a replacement piece the cooperation of the Health Sector Authorities is requested.

Independently from the positive manifestations with respect to the project, it was considered that it does not replace the real need for energy, panels are missing and batteries are not adequate. In La Parroquia and La Taña there are community maternity hospitals where the operating room is being implemented, which definitely demands a stronger capacity in energy supply.

This project has come to motivate local participation the local Pro-health Committees, who participate in the care of the system. In the task of supporting the care of the system the Uspantán National Hospital, the Health care provider and the Area authorities have an important part. The *FUNDACIÓN SOLAR* has provided support through the training of a local energy promoter and a nursing assistant for the health centers.

In the search for support for extending the use of energy beyond the cold chain and lighting, several negotiations have been undertaken in the institutional context, both in the district and in the authorities of the area, municipality and JH PIEGO, by initiative of the health authorities in the area. In several communities it was mentioned that there are good possibilities of obtaining the energy supply from the national grid (mainly INDE, DEOCSA, DEORSA, and Unión Fenosa).

2. EVALUATION OF THE EFFECTS ACHIEVED BY THE PROJECT

2.1 DEGREE OF THE EFFECT INDICATORS

In order to determine the degree of compliance with the indicators a frequency distribution analysis was carried out for each of the variables contained in the home survey ballot. A total of 249 households were randomly selected. These pertain to the four study groups.

In order to build the indicators, the defined variables for each indicator were grouped. These were weighed so that a comparison using the Chi Square test could be done (See Appendix 2: Variable organization according to Analysis Indicator).

TABLE No. 1
Households participating in the survey

GROU P	COMMUNITY	FREQUENCY	PERCENTAG E
A, B	Pa'l	63	25.30
A, B	Santa Clara	66	26.51
C	Chel	30	12.05
C	Las Flores	30	12.05
D	Juá *	30	12.05
D	Chemal *	30	12.05
	TOTAL	249	100.00

Source: Data obtained from the final summary from the PD database May, 2002.

* Witness communities

Initially 225 surveys were planned, but it was possible to do 249 in order to have a bigger number of ballots, which permitted a more reliable analysis. The household leader and spouse were the ones who responded most of the surveys (91.75%). In The case of the communities of Group A, a higher number of participants is evident since in Pa'l and Santa Clara 30 interviews with PLS owners and 33 and 36 with families who have not been benefited with a PLS were carried out.

In relation with education, 100% of the interviewees in the 6 communities claimed to agree with sending their daughters to school, 96.72% agreed with sending their daughters who were younger than 7 to school. On the other hand, 98.8% of the interviewees claimed that they agreed with sending their sons to school and 97.98% claimed that they agreed with sending their sons who were younger than 7 to school.

In general terms, it can be assumed that there is a great interest by family parents in sending their children to school and the difference in percentages is not significant when comparing groups ($p > 0.05$).

On the basis of the findings, it can be inferred that the end of the internal armed conflict, the Peace agreements promoted and encouraged by different governmental and non-governmental organizations and the external cooperation is generating more accessible conditions for having the right to education, at least in children younger than 7.

Table No. 2
Housing situation

THE HOUSE	FREQUENCY	%
Is owned by the family	244	97.99
Has zinc plates on the roof	240	96.39
Has wooden and lepa (rustic wood) walls	244	97.99
Has dirt floor	245	98.39
Has 1 or 2 rooms	85 + 141	92.24

Source: Data obtained in the PD surveys May, 2002

Based on the evidence found in the surveys it is observed that the general conditions of the houses regarding ownership is that houses are mainly owned by the family (97.99%). It was also found that there is a prevalence regarding the materials of the roof (zinc plate) and walls (wood-lepa), which together with the predominance of dirt floor, constitutes a low quality housing.

It could be considered that these data could be generalized in the rest of the families and neighboring communities in the area of influence of the *FUNDACIÓN SOLAR* project, which immediately poses difficult conditions for the families of this geographic zone.

Nevertheless, the sanitation conditions regarding the use of latrines would seem to be dramatically changing in the communities, since 96.39% mentioned in the interview that they had latrines. As shown in Table 3, the tendency of using latrines is general in the interviewed communities, and thus it could be assumed that the same situation could be happening with the whole population of these communities. This reflects a positive aspect of the work done by other organizations in the area.

Table No. 3
Interviewed families that claimed not to have latrines
Chajul, Quiché, 2002

COMMUNITY	FREQUENCY*	%
Las Flores (Group C)	29	96.67
Chemal (Witness)	26	86.67
Chel (Group C)	30	96.67
Santa Clara (Groups A y B)	65	98.48
Pa'l (Groups A y B)	60	95.24
Juá (Witness)	30	100.00
TOTAL	240	96.39

Source: Data obtained in the PD survey. May, 2002

* The frequency reported in this table of 240 is a total of 249 interviews

The sanitation of the area in relation with the situation of the water can be seen in the following tables

Table No. 4
Where is water obtained?
Interview to 249 households in 6 communities
Chajul, Quiché, 2002

PLACE	FREQUENCY	%
River	72	28.92
Own well	7	2.81
Public well	4	1.61
Own spring	136	54.62
Public spring	15	6.02
Neighbor's spring	11	4.42
Other	4	1.61
TOTAL	249	100

Source: Data obtained in the PD surveys, May, 2002

Table No. 5
Where is water obtained?
Interview to 249 households in 6 communities
Chajul, Quiché, 2002

Place / Community	Pa'l		Sta. Clara		Chel		Las Flores		Chemal		Jua	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
River			58	87.8	1	3.3	3	10.0	2	6.7	8	26.7
Own well			3	4.5			1	3.3			3	10.0
Public well			1	1.5			1	3.3	1	3.3	1	3.3
Own spring	62	98.4			25	83.3	21	70.0	19	63.3	9	30.0
Public spring	1	1.6			2	6.7	4	13.4	6	20.0	6	20.0
Neighbor's spring					2	6.7			2	6.7	3	10.0
Other			4	6.2								
TOTAL	63	100	66	100	30	100	30	100	30	100	30	100

Source: Data obtained in the PD survey ballot. May, 2002

In Table 5 it can be seen that 4 of the interviewed families in the 6 communities mentioned having their own spring for obtaining the water that they use. In the case of the community if Santa Clara, there is no such service and in Juá only 30% of the interviewed families mentioned having their own spring for this service.

Table No. 6
Where is drinking water obtained?
Interview to 249 households in 6 communities,
Chajul, Quiché, 2002.

PLACE	FREQUENCY	%
Well	75	30.12
Spring	163	65.46
Spring	11	4.42
TOTAL	249	100

Source: Data obtained from the PD surveys. May, 2002.

The previous table indicates and confirms at the same time that families also obtain drinking water from their own spring, except for Santa Clara, where 100% of drinking water is obtained from the well. Regarding other sanitation services such as drainage and

waste collection, none of the 249 interviewees in the 6 communities mentioned having them.

In relation with the existence of a house telephone or cellular telephone only the Chel community mentioned having three community telephones that service them and other neighboring communities. The existence of telephones in Chel has been an initiative supported by the *FUNDACIÓN SOLAR* and implemented by the *Asociación Chelense de Eletrificación* by means of a credit granted by BANRURAL.

Of the 6 subject communities, only two (Pa'l and Santa Clara) have a PLS (Photovoltaic Lighting System). From the 100% of the households that have a PLS, 89% mentioned that the system rarely failed, 11% said that the system has failed between one week, 15 days or one month. Based on this, it can be assumed that the operation of the PLS has been acceptable, indicating thus good quality materials or and adequate use and maintenance.

Regarding the existence of home appliances (radios, recorders, 12 v televisions) and who uses them, the most frequent responses were that wives and all other family member use them in 45.19% and 37.50% of the cases, respectively. The remaining 17.31% is represented by the husband or children.

In relation with the purchase of repair parts, 98% of the interviewees that have a PLS said that they buy them within the community and in the municipality against a 2% that buys them in the Department. Probably, the purchase done within the community is directly at the local sale of parts that *Fundación Solar* has implemented.

Regarding the type of parts that interviewed families that have a PLS most often buy, light bulbs represent 58.1% and other parts represent 20%. The remaining 21.9% is represented by switches, cables, fuses, and plugs. It can be inferred by the type of part that is most frequently purchased that the PLS is well-accepted in the community since its maintenance cost is reduced to light bulbs. The parts are purchased with a frequent periodicity that goes from 1 to 3 months.

Nevertheless, having a PLS has not been enough for families to open a business. 90.57% of the interviewees had a negative response to the question of being able to open a business with the electrical energy that they have.

Arguments expressed by the interviewees include the fact that the system does not let them have much more than a radio, three light bulbs and scarcely a TV. The remaining 10% said that they already had a business (store), but that the PLS has enabled them to close at a later time generating some extra income. These interviewees said that the ones who participate in the business are both men and women.

Table No. 7
Weekly Cost of Fuels in Quetzales
249 interviewees in the 6 communities
Chajul, Quiché. 2002

Type of fuel	Purchase range Q0.01 - Q.2.50 Low		Purchase range Q2.51 - Q7.30 Medium		Purchase range Q7.31 - Q15.00 High		TOTAL
	Freq.	%	Freq.	%	Freq.	%	
Candles	102	41.64	105	42.86	38	15.52	245
Ocote	182	80.18	33	14.54	12	5.28	227
Gas	115	52.98	81	37.32	21	9.67	217
TOTAL	399	57.91	219	31.79	71	10.30	689

Source: Data obtained from the PD surveys. May, 2002.

For effects of interpretation quartiles were built dividing by 3 the total frequencies that appeared in the results and adding the percentages of the frequencies that corresponded to each quartile.

In the previous table it can be noted that the frequencies for “purchase range” lower than Q2.50 is the one that has the highest number for candles, ocote and gas (57.91%). This could represent a relatively low weekly spending for these products as a whole for the interviewed families.

Table No. 8
Spending frequency for purchasing fuels
249 interviewees in the 6 communities
Chajul, Quiché. 2002

Community	PLS				Micro Hydro				Witness			
	Pa'l		Sta. Clara		Las Flores		Chel		Chemal		Juá	
Variable/ spending	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Candles	37	58.7	42	63.6	11	36.7	12	40.0	23	76.7	10	33.3
Ocote	59	93.6	61	92.4	20	66.7	19	63.3	29	96.7	27	90.0
Gas	38	60.3	59	89.4	14	46.7	15	50.0	22	73.3	27	90.0

Source: Data obtained from the PD surveys. May, 2002.

In order to analyze the data in Table 8, the communities have been arranged according to their situation at the moment of the interview in PLS, MHY and witness. Therefore, the distribution of frequency in the spending for buying candles, ocote and gas by community can be observed.

When comparing both witness communities, Juá and Chemal, it can be seen how the families interviewed in Chemal were the ones who mentioned the highest expenditure for buying candles (76.7%) among the witness communities and the 6 subject communities, probably because they do not have any form of electric energy in this moment. In the case of Juá, which is also a witness community, the expenditure for buying candles was lower than all other communities (33.3%) since in this community the are PLS's installed by another NGO's some years ago.

Regarding the communities of Pa'l and Santa Clara, that have PLS's, the percentage in the expenditure for buying candles may seem high, but it must be considered that in these

communities both families that have PLS's (Group A) and families that do not have them (Group B) were included, which influences the frequency. It is highly probable that expenditure for buying candles by families with PLS's in these communities is very similar to the data reported by the community of Juá.

The expenditure for buying ocote is very unpredictable and complex, since the comments expressed by the interviewees include the collection process, that is, this is a wood resource that in most cases is not bought, but directly obtained from the forest, which is also the case of firewood. In this sense, this is probably why there is a low purchase.

2.2 COMPARISON OF INDICATORS

Appendix 3 illustrates the form in which variables were weighed. These were then integrated in evaluation indicators for measuring the effects. For the comparison, only those indicators that were subject to be compared were included with the purpose of having common elements both between groups of subject communities and of witness communities.

A total of 14 indicators were built (See Appendix 2), from which, only indicators 2-7, 8 and 10 were analyzed for discussing the effect results; indicators 8, 11, 12, 13, and 14 are specific for each analysis group and their frequencies were 100%, therefore it was not possible to compare them. The results of each indicator are included in the output flows of the statistical analysis (see Appendix 6, Output flows for Data for the Chi Square Test).

The Chi Square Test permitted to find significant differences in the studied groups almost for all compared indicators, both between groups (A, B, C, and D) and in the subject community – witness community grouping.

a. Family size

Regarding family size (Indicator 1) two categories were established: Category 1 includes households with 1 to 5 family members and Category 2 includes households with more than 5 family members. It was found that in Group B, there is a higher percentage of normal families regarding size with 79%. Group A has the highest percentage (66.7%) of big families (6 or more members).

TABLE 1
 Indicator 1: Family Size

GROUP	Category 1 5 members or less	Category 2 More than 5 members
A	33.33	66.67
B	79.17	20.83
C	51.67	48.33
D	45.00	55.00

Significant differences were found for an Alfa <0.05

b. Socioeconomic situation

Regarding the economic situation of the families, it can be observed that Groups C presents the most acceptable conditions for this indicator. In order to carry out the Chi Square Test two categories were established (as well as for all other indicators): Category 1 included the poorest conditions and Category 2, the more acceptable conditions, taking into account housing and other socioeconomic variables.

TABLE 2
 Indicator 2: Socioeconomic Situation

GROUP	Category 1 Extreme	Category 2 Poor
A	41.98	58.02
B	56.25	43.75
C	15.00	85.00
D	30.00	70.00

Significant differences were found for an Alfa <0.05

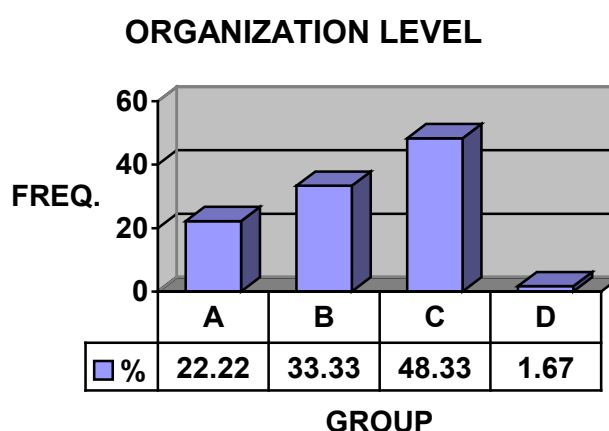
Reliability Ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
18.88	29.19	8.43	13.04	20.48	31.68	16.87	26.09

c. Community Organization

A very important aspect is community organization. From the analysis of this indicator, it can be inferred that the project has directly influenced the community participation and organization levels, which is clearly seen in the following graph.

GRAPH 1



Graph 1 shows the comparison between the four groups studied in their levels of organization. The bars show that Group D (Witness) has the lowest value, which represents a poor participation level in comparison with the rest of the groups (subject communities).

The best group is Group C, constituted by the communities of Chel and Las Flores, where the micro-hydroelectrical plant is being implemented. It is the group that showed the highest percentage of frequencies (48.33%), which shows that the Asociación Chelense has influenced in the levels of community organization.

The Chi Square Test for the group of subject communities (Groups A, B, and C) in comparison with the witness communities (Group D) was evaluated for two different categories: the first one groups the occurrence levels of the groups that presented a low

level of organization, measured by the participation , motivation and limits for participating.

The second category includes the groups that have attained good levels of organization and participation of the beneficiaries. The data reflect that the participation levels measured have significant differences. The average values are:

TABLE 3
 Indicator 2: Community Organization
 Groups of subject and witness communities

GROUP	Category 1 Low level	Category 2 Good level
A, B, C	66.67	33.33
D	98.33	1.56

Significant differences were found for an Alfa <0.05

Reliability Ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
7.23	28.13	6.43	25.00	11.65	45.31	0.40	1.56

This table permits to infer that for Category 1 (low participation level), Group D has the highest percentage. For Category 2 (good participation level), the subject communities have a higher value.

d. Management level

This indicator, measured by decision-making, levels of information for beneficiaries and support for concluding the project was divided in two categories: the first one represents the groups with a poor management level and the second one represents groups that had a good management level through committees or associations.

The results permit to observe in terms of quantity and graphically for Category 1 that the witness group has a poor management level compared with the rest. On the contrary, Group C is the one that shows a good management level (Category 2) in comparison with the rest of the group.

Table 4 shows the average values obtained in the comparative statistical analysis between groups, as well as the comparison between subject communities and witness communities for the management level.

GRAPH 2

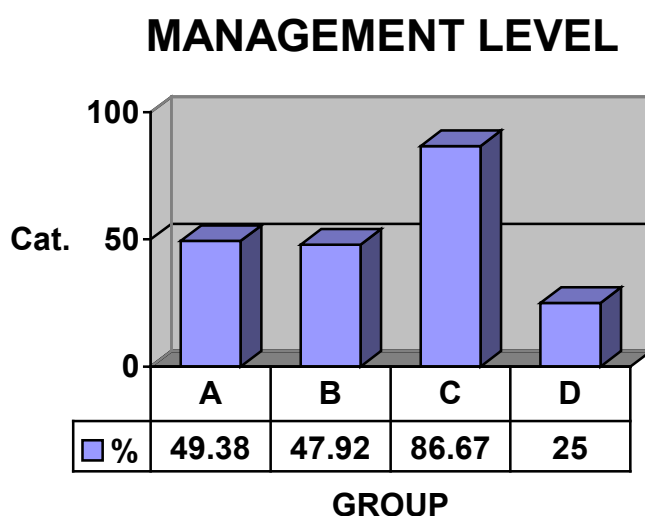


TABLE 4

Indicator 4: Management level by group and by community groupings

GROUP	Category 1 Poor	Category 2 Good	GROUP	Category 1 Poor	Category 2 Good
A	50.62	49.38	A, B, C	39.15	60.85
B	52.08	47.92	D	75.00	25.00
C	13.33	86.67			
D	75.00	25.00			

Significant differences were found for an Alfa <0.05

Reliability Ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
16.06	30.77	9.24	17.69	20.88	40.00	6.02	11.54

e. Participation of women

The participation of women is an indicator whose value range, on the basis of the defined variables (0-12), permitted to establish three categories for the analysis, which were defined as follows:

- Category 1: Reflects a poor participation level
- Category 2: Represents an average level of participation
- Category 3: Represents an acceptable level of participation

For the analysis, it was demonstrated that there are highly significant differences (Alfa<0.05) for the evaluation between groups. After analyzing the behavior of this indicator for the subject and witness communities (grouping of A, B, and C against D), significant differences were found for an Alfa = 0.05.

TABLE 5
 Indicator 5: Participation of women by analysis group

GROUP	Category 1 Poor	Category 2 Average	Category 3 Acceptable
A	2.47	61.73	35.80
B	58.33	41.67	0.00
C	83.33	16.67	0.00
D	56.67	43.33	0.00

Significant differences were found between groups A and the rest and Group C and the rest for an Alfa = 0.05

TABLE 5A
 Indicator 5: Participation of women by community grouping

GROUP	Category 1 Poor	Category 2 Average	Category 3 Acceptable
A, B, C	42.33	42.33	15.34
D	56.67	43.33	0.00

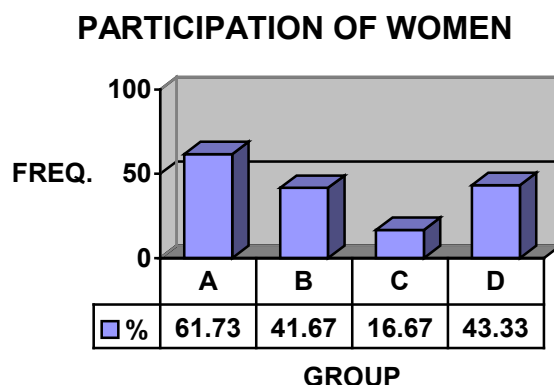
Significant differences between subject and witness communities, for an Alfa = 0.05; there is a probability of 0.0036

Reliability ranges:

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
20.08	100.00	8.03	18.87	4.02	9.43	10.44	24.53

Graph 3 shows the behavior of this indicator, measured for the four analysis groups, in which it can be observed that Group A (communities with PLS's, Pa'l and Santa Clara) is the best group regarding the participation of women in the processes of implementation of the project. When comparing the grouping of subject and witness communities, it can be observed that the project has had a positive influence in promoting the participation of women, influencing in turn the rest of the groups, as seen by the results of Group A.

GRAPH 3



The individual analysis shows that there are differences between Group C and the rest of the groups of subject communities. This could seem contradictory with the expected project results. However, the characteristics and cultural patterns of communities must not be overlooked. These are different from one another regarding the role of women. Anyway, it can be inferred that the project has motivated the participation of women.

f. Use of traditional fuels

The indicator on use of traditional fuels measured by the analysis of weekly purchase of ocote, kerosene and candles shows a result consistent with what is expected by the project. Two categories were constructed. The first one (Category 1) shows the groups that have had a higher use of fuels. Group A (communities that have a PLS) was the best one, statistically different from the rest of the groups ($p > 0.05$). Group B, which includes the same communities had the poorest result in this category, since it reflects the highest levels of purchase of these fuels.

TABLE 6
 Indicator 6: Use of traditional fuels
 by group and community grouping

GROUP	High use	Low use	GROUP	High use	Low use
A	23.46	76.54	A, B, C	47.62	52.38
B	81.25	18.75	D	55.00	45.00
C	53.33	46.67			
D	55.00	45.00			

No significant differences were found for an Alfa = 0.05

Reliability Ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
24.90	49.21	3.61	7.14	11.24	22.22	10.84	21.43

After making a comparative analysis between subject and witness communities, the negative influence of Group B, and the fact that in the community of Juá (witness group) there are solar panels, grants better conditions to witness communities, even though there are no significant differences for an Alfa = 0.05.

This permits to note that the project has had a positive influence in the savings in the use of fuels, which represents a 30.7% in Group A in relation with the average of groups C and D, and of 57.8% with respect to Group B, which was the worst group for this indicator, statistically different from the rest of the groups ($p > 0.05$).

It is important to consider that the objective of decreasing CO₂ emissions has been met through the implementation of renewable energy projects, which is demonstrated in the communities that have a photovoltaic lighting system (Group A) This group is the one with better conditions (a low value) for Category A, which represents a low purchase level given that the value is lower as well as a high weight for Category 2, which represents a low purchase level for a high weight.

g. Interest in education

When indicator 7 “interest in education” was evaluated, no significant differences were found, since more than 97% in all communities express an interest in that children go to school.

Even though there is a tendency for the witness group of showing the best conditions in the individual analysis and in the group of subject communities, the Chi Square Test showed

no differences. This can be interpreted in the sense that the project has not influenced the promotion of school in the communities of the influence area.

TABLE 7
 Indicator 7: Interest in Education by group and by community grouping

GROUP	Category 1 Low interest	Category 2 High interest	GROUP	Category 1 Low Interest	Category 2 High interest
A	4.94	95.06	A, B, C	7.94	92.06
B	8.33	91.67	D	1.67	98.33
C	11.67	88.33			
D	1.67	98.33			

No significant differences were found for Alfa = 0.05 in any case.

Reliability Ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
30.92	33.05	17.67	18.88	21.29	22.75	23.69	25.32

h. Work of the Committee

Another indicator that was observed was the “work of the committee”, measured by the level of participation and management of the committee in favor of the communities that it represents. In this sense, there was a great similarity between groups A, B, and D (witness), since their behavior was very similar, even when Group D shows better values. Group C (communities of Chel and Las Flores) showed different conditions to the rest of the groups, which reflect a weak level of work, caused by the fact that in these communities the *Asociación Micro Hidroeléctrica Chelense* was created simultaneously to the creation of the development committees. In this sense, the influence is that answers were oriented to committees that were foreign to the process, since the work of the Association has been very well evaluated by the beneficiaries.

In the comparative analysis between subject and witness communities no significant differences were found when analyzing the work of the committee, even though the data are slightly favorable for the witness communities.

TABLE 8
 Indicator 9: Work of the Committee
 by group and community grouping

GROUP	Category 1 Low level	Category 2 Good level	GROUP	Category 1 Low level	Category 2 Good level
A	16.05	83.95	A, B, C	23.28	76.72
B	16.67	83.33	D	15.00	85.00
C	38.33	61.67			
D	15.00	85.00			

No significant differences were found for Alfa <=0.05

Reliability Ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
27.31	34.69	16.06	20.41	14.86	18.88	20.48	26.02

The measurement of this indicator must be observed closely, since the project poses the introduction of innovative forms of community organization, and even though the measurement of this specific indicator indicates positive achievements in terms of organization, the same thing cannot be said about the measurement of the work of the committee.

In this sense, it is valid to have an element for deliberation that enables the analysis of the performance of the Committee supporting the represented communities, which has to be carried out simultaneously to the performance of the Asociación Chelense, which has even achieved to negotiate telephone projects that have benefited the communities in this group (C).

i. Environment

Finally, an indicator on environment was evaluated and measured by the use of traditional fuels and their consumption. The use that the traditional fuels are destined for was also considered. This use can be sale or consumption.

Simultaneously, the incidence of common diseases was considered as an important variable for the construction of this indicator. Such incidence could be influenced by the emission of smoke within the households causing eye or air passage irritation. For this indicator, two categories were built, as was the case with most other indicators.

Category 1 represents a low level of environmental protection since it includes the average of responses in the “low” category given to the respective variable (that constitutes this indicator). Furthermore, the numeric value range with which the indicator was built is wide (between 0 and 11). None of the groups obtained the highest value (11).

TABLE 9
 Indicator 10: Environment; by group and by community grouping

GROUP	Category 1 Damaged	Category 2 Protected	GROUP	Category 1 Damaged	Category 2 Protected
A	23.46	76.54	A, B, C	40.21	59.79
B	47.92	52.08	D	25.00	75.00
C	56.67	43.33			
D	25.00	75.00			

Significant differences were found for Alfa = 0.05

Reliability ranges

GROUP A		GROUP B		GROUP C		GROUP D	
Li	Ls	Li	Ls	Li	Ls	Li	Ls
24.90	39.24	10.04	15.82	10.44	16.46	18.07	28.48

This indicator permits a fairly real comparison on the basis of the expectations that the evaluating team posed. On the one hand, the behavior of Groups A and D is expected since

in Juá and in the communities of Group A there are photovoltaic lighting systems, which permits a very similar behavior in the analysis.

It is interesting to observe that the negative influence that Groups B and C (which do not have this type of lighting) exert affects the result of the comparative analysis between the subject and the witness communities, since in this analysis the best group is the one of witness communities.

When comparing the results of the groups that have photovoltaic lighting, it can be observed that the data obtained show percent values for this indicator that indicate that there has been an environmental improvement in the communities of Group A and the witness communities.

This comparison established differences of 24.5% between Group A (that has PLS) and Group B (homes in the same communities, but without PLS's). In the same way, the comparison between groups A and C showed a difference of 33.2% in favor of environmental protection, which could be interpreted as a decrease in the incidence in the mentioned diseases: eye redness, coughing and cold.

The data reported in the analysis show an important similarity between group A and the witness group (D) since they showed similar results, which is consistent with the fact that in homes of the village of Juá there are PLS's implemented by another project.

It can be said, then, that the project is extremely important in terms of the accomplishment of the set objectives, since the importance of substituting traditional fuels by renewable energy as a means for protecting the environment and the health of the inhabitants of the beneficiary communities has been statistically demonstrated.

VII. STRENGTHS AND WEAKNESSES ANALYSIS

1. Strengths:

- 1.1 The project is implemented in a zone characterized by a high dispersion of the communities, with remote possibilities of getting connected to the National Energy Supply Grid. This generates a great interest by different government and non-government entities, which opens expectations of implementing a full scale project.
- 1.2 *FUNDACIÓN SOLAR* has a high level of credibility in the institutional context, due basically to the professional career of its current Director. This aspect provides a strength for carrying on with the vision of replicating the experience gained in El Quiché in other areas of the country.
- 1.3 In any dimension that the project is implemented, it must be said that it has achieved the local participation and the participation of community leaders, basically because of the respect people have for the existing organization and the democratic election of community representatives for a specific project y because of the visible results or the project.
This aspect has been transmitted to other communities of the Ixil region, which opens spaces for local cooperation for developing initiatives in the search for accomplishing the Full Size Project.
- 1.4 The project has involves staff with a good level of experience, both in subjects related to the environment and to renewable energy and of technical staff who have been responsible for building local capacities for providing maintenance to the system. The fact that there are local resources, and in the case of photovoltaic lighting, that members of the community and other beneficiaries who have learned to monitor the operation of the system has been a strength in favor of sustainability.
- 1.5 The interventions of *FUNDACIÓN SOLAR* in the area of influence of the project have gone beyond the field of renewable energy and have reached the objective of promoting local capacity in El Quiché for the development of pre-investment phases of different projects. In this sense, the role of the Fundación in strengthening local capacities and in aspects focused on strengthening the existing community organization has become evident.

2. Opportunities

- 2.1 The Ixil area is fertile ground for this type of projects, as well as the Reyna zone, where around 85-68% of the communities are official, many of which are in river banks. Energy supply through the national grid is still far for many communities, which opens the path for initiatives such as the one of *FUNDACIÓN SOLAR*.
- 2.2 There are many institutions interested in strengthening these initiatives, in favor of replicating the experience in other communities who suffer from poverty or extreme poverty in the country. The concrete case is the Instituto Nacional de Electrificación, INDE who has expressed that there are resources so that organized communities that are going through a process of management and implementation have access to rural electrification.
- 2.3 The analysis of the environment and use of fuels indicators enabled to demonstrate that the use of clean energy has a direct impact on greenhouse gas (GHG) emissions, which

was demonstrated by the low use of candles, kerosene and ocote. This aspect has interest for some organizations like the GEF, and through such interest the list of strategic allies for development can be enlarged.

- 2.4 Even when differences were found in the management of municipal authorities in the Ixil region a valuable opportunity is present since three mayors mentioned the importance the importance of the “microenterprise development by means of renewable energy in El Quiché” project. There was an important consensus regarding the interest of replicating the experience in the communities mentioned in the “Communities with potential for developing micro-hydroelectric projects” table.
- 2.5 The *FUNDACIÓN SOLAR* has a technical and professional team specialized in conducting initiatives in this field independently from its size. This fact, together with the accessibility and the need therein this region for bringing an integral development to the more excluded communities offers great possibilities for replicating this experience, which has to be linked to an integral approach for the management of the locally coordinated development processes.
- 2.6 The project generated local resources trained in all phases that the implementation of renewable energy projects demand, based on the contributions of different government and non-government organizations, which permits having human resources for multiplying the effect achieved through the training of these persons.

3. Weaknesses

- 3.1 The current level of implementation of the project, especially in the achievements for concluding the microhydroelectrical plant, has discouraged some direct beneficiaries, according to additional comments expressed during the home visits. Furthermore, some institutions are concerned about the initiative not being concluded or about the fact that when it is concluded, the financial support is no longer available. Such is the case of the Quiché Program of the European Union, which concludes next July.
- 3.2 The project implemented in Pa’l and Santa Clara is not capable of generating microenterprise development, because of the nature of photovoltaic systems since they do not provide sufficient energy for activating the electrical equipment proposed in the Project Document, trying with this to increase family income. The only possibility for this case is limited to the use of lighting for weaving work and others done by women, which implies extending their work day.
At the moment of the evaluation, energy supply through the micro-hydroelectrical plant is still not achieved, since it is necessary that political, economic and local participation problems are surmounted in order to conclude the project. This situation is, up to a point, an obstacle for reaching the expected results in socioeconomic aspects and in the quality of life through the generation of income.
- 3.3 There have been some questionings regarding local staff that represents the *FUNDACIÓN SOLAR*, which has originated misunderstandings with arrogant and impositive attitudes. This was perceived in the municipal corporation of San Gaspar Chajul.
This situation has gotten worse with other statements that could even be ill-intentioned, such as the interest of the *FUNDACIÓN SOLAR* of appropriating of reserve areas, the unwillingness for paying for non-qualified manual labor, the political connotation conferred to the *FUNDACIÓN SOLAR* at the municipality of Chajul, etc. These statements have had repercussions in the levels of community participation.

3.4 Some persons from institutions and organizations present in the area mentioned that the role of the *FUNDACIÓN SOLAR* is not totally clear, specially in Nebaj and Cotzal, which permits to infer the low level of promotion of its institutional activities, its objectives and the activities it carries out in favor of environment and development through the implementation of integral programs based on the use of renewable energy.

4. Threats:

4.1 There have been risks that threaten the good performance of the project in the Reyna zone, mainly because of administrative, financial and compliance with commitments aspects. In this sense, the authorities of the area are responsible for the supply of insumos and mobilization expenditures, which will be stated in the signed agreement.

The municipality, the Maternal-infant health program of JHPIEGO and the service provider had not kept their commitments of strengthening community organization. Such commitments are indicated in the signed agreement.

4.2 In the area of Usphantán, the *FUNDACIÓN SOLAR* made the commitment of monitoring the cadena de frío until September 2002, implement the installation of radio communication equipment for the 6 health centers. Regarding the monitoring process, it was mentioned that the presence of the *FUNDACIÓN SOLAR* in the area is minimal, and it has not permitted to have exchange of opinions, doubts, etc. Regarding the installation of radio equipment, the fact of not having reached the objective affects the emission of weather reports, as well as the daily, weekly and monthly reports.

4.3 The image (visibility) the *FUNDACIÓN SOLAR* transmits in the municipal context (area of influence) causes that the implemented actions are perceived as an intervention done solely by the *FUNDACIÓN SOLAR*, leaving out the cooperating institutions, who have the direct co-responsibility of the financial implementation of the project. This constitutes a risk in the sense that communities put their expectations for satisfying perceived needs in renewable energy projects of the *FUNDACIÓN SOLAR*. If this is not a reality, it would be a threat for the image and credibility of the *FUNDACIÓN SOLAR*.

This last fact was evident in the survey carried out with the municipal corporations, who clearly mentioned that they were aware of the origin of the resources. Notwithstanding, in every activity that the *FUNDACIÓN SOLAR* carries out, it has specifically taken the opportunity for recognizing each and every one of the cooperating institutions. Therefore, the ignorance in this regard is due to purely cultural aspects, which are characteristic of the region.

VIII. CONCLUSIONS

1. On the process

1.1 The project achieves particular results regarding the removal of financial barriers for implementing renewable energy projects to a great extent, This is evident by the high level of support that make the accomplishment of this first phase of the project a reality. The actions of the *FUNDACIÓN SOLAR* go beyond the sole implementation of the physical work, especially in the aspects of: generation of local resources, trained in different subjects that span from community organization to the use and maintenance of the system.

As part of the management process, the principal financial barriers were identified. Many of them are linked to the high levels of exclusion of the communities in the area of influence, as well as the meager possibility of achieving electric energy supply in the area. Currently, the communities that have been provided with this service lack efficiency in the supply.

1.2 The process of working together with the *FUNDACIÓN SOLAR* manages to encourage the *Asociación de Chel* to reach out to other credit institutions with the objective of implementing a project of rural telephones, which exceeded every expectation regarding the payment of the credit. This is translated into an important accomplishment in the objective of removing the financial barriers and increasing the security that institutions need for achieving success in their productive activities.

1.3 The intentions of the *FUNDACIÓN SOLAR* are still positive in the sense of contributing to the general improvement of the subject populations. Even so, it must be acknowledged that essential aspects such as the coordination with municipal governments, and community participation and organization must be approached with vital importance that ensures the future success.

1.4 The *FUNDACIÓN SOLAR*, in the process of working together with the communities achieves the empowerment of the communities on the fundamentals of renewable energy, which is made evident by the implementation of 6 training sessions in which 10 men and 8 women from the community took part. These events dealt with subjects like rural credit, environment, energy policies, community organization and PLS's, among others. From these initiatives, renewable energy and the use and function of natural resources are known.

1.5 The experience in the implementation of the medium size project provides tools for estimating the real possibilities for reducing the implementation costs, which is based on the use of local resources, on the increase the levels of community participation and interinstitutional coordination in order to make good use of the technical and professional resources (for example: two theses in Business Administration from the Universidad de San Carlos in Guatemala propose financial mechanisms and administrative structures for the project). This situation demonstrates that the reduction of implementation costs is possible through an adequate harmonization of strengths in the professional, technical and community leadership fields. It must be said that in this vision, municipalities play a crucial role.

2. On the effect

- 2.1 Family size, considered as an indicator that indicate the number of family members, showed that in the households of group B (villages of Pa'l and Santa Clara), which do not have a PLS, there are less members, since only 20% of such households have more than 5 members. This means that the project had preference for larger households, since in group A, 67% of households has more than 5 members. Groups C and D have 48% and 55% of households with more than 5 members, respectively.
- 2.2 The project directly influenced the levels of community organization, since this indicator, measured by community participation, motivation for participating in the project and obstacles for participating showed that communities in group D (witness) have the worst level of organization (average value of 1.76%), which is different from the rest of the subject communities (22.22% for group A; 33.33% for group B and 48.33% for group C). Group C, integrated by the communities of Chel and Las Flores showed the highest level of organization, which can be explained by the conformation of the *Asociación Micro Hidroeléctrica Chelense*.
- 2.3 The evaluation of the management level determined that groups A and B (49.38% and 47.92%) are statistically similar to each other and different from groups C (86.67%) and D (25%). The analysis of this indicator demonstrates that in the subject communities: Pa'l and Santa Clara, the management level is 23% higher than that of the witness communities. The communities of Chel and Las Flores (group C) show the highest value in the management level. This is attributed to the role of the *Asociación Chelense*, since the value reached in the evaluation is 61% higher than the value of the witness group and 38% higher than groups A and B.
- 2.4 Regarding the participation of women, when statistically analyzing the indicator it was found that all groups showed significant differences (for Alfa = 0.05), having found that group A (61.73%) has achieved almost 20% more participation of women, compared with groups B and D (similar to each other: 41.67% and 43.33%, respectively, and different from group C (16.67%), which was the group with the worst level of participation of women (17%).
- 2.5 One of the objectives of the project is the mitigation of climate change by the elimination or substitution of the use of traditional fuels by renewable energy systems. The statistical analysis of this indicator permitted to find significant differences between group A (that has photovoltaic lighting) and the rest of the groups. From this finding, it can be concluded that there is a positive effect in favor of the mitigation of climate change. Group A had a better behavior in the measurement of this indicator (76.54%), compared with the rest of the groups (B = 18.75%; C = 46.47%, and D = 45.00%), which means that if the percent value is higher, there is a higher incidence in the mitigation of climate change.
- 2.6 The project applies a positive effect on the decrease of CO₂ emissions, through the reduction in the use of traditional fuels. It was statistically demonstrated that in the subject communities there were significant differences in the levels of purchase of traditional fuels, which represents a difference of more than 40% in the purchase of candles, ocote, kerosene, and batteries in comparison with groups B and C, where there is no lighting. Therefore it is concluded that the use of clean energy is an alternative for the use of

candles and kerosene lamps with the purpose of lighting, which is a much more interesting element in the context of the participating institutions.

2.7 The analysis of the indicator related with the operation of the system did not reflect any difference as a result of the analysis for groups B and C (0%), because of the fact that in the communities that integrate these groups there is no energy supply, In the case of witness group D it was found that the system has operated normally, that is, with a low number of technical failures in 40% of the cases (for a n=24). This is due to the fact that in Juá there are solar panels in most of the households surveyed. Group A showed an expected behavior, since 100% of the interviews indicate that the system is working normally and that the failures shown are mainly due to the need of replacing light defective or blown out bulbs.

From this finding, it is concluded that the project has introduced important improvements in its management, as well as in maintenance and control aspects, which was made evident by the 60% difference between group A (that has PLS's) and witness group D regarding the quality of operation. Such a high value is affected by the fact that only one of the two communities in the witness group (Juá) has PLS's.

2.8 The evaluation of the indicator "work of the committee" measured by the support and orientation that the beneficiaries receive, as well as by the opinion expressed in regard to its performance showed results that contradict to some extent the performance of the *Asociación Micro Hidroeléctrica Chelense*, since the group that reported the lowest results for this indicator was group C (61.67%). This is justified by the fact that the instrument for data capture made an explicit reference to the "work of the committee", which generated answers that indicate the performance of the committees in favor of improvement and others that exist in the communities of Chel and Las Flores.

Groups A, B, and D are statistically similar to each other (83.95% , 83.33% and 85.00%, respectively), which indicates that no significant differences were found that could make reference to the work that the committee carries out.

2.9 When analyzing the indicator on environment", it was found that groups A and D (witness) are statistically similar to each other (76.54% and 75.00%) for Alfa < 0.05, and different from group B (52.08%) and C (43.33%), which is explained by a reduction in the use of forestry resources (ocote and firewood) and the decrease in the use of candles and kerosene. When this is converted into currency it represents weekly savings of up to Q10.00 in candles and Q15.00 in kerosene. This is due to the fact that they have a lighting system (in the case of the witness group, the positive result is influenced by the fact that in Juá they have PLS's), which permits the elimination of the use of traditional fuels, at least in regard to lighting.

2.10 A very important aspect to mention is the reduction of diseases associated with smoke in the households, such as: eye redness, cold, coughing, or skin irritation, which was measured for 15 days previous to the survey. This is evident, especially for the communities of Pa'l, Santa Clara and Juá, communities that have PLS's. The average data indicate a reduction of up to 20% in eye redness, 9% in colds or coughing and 17% in skin irritations detected in group A, in comparison with the rest of the communities evaluated, in which traditional systems are used for lighting.

IX. INPUTS FOR LEARNED LESSONS

Part of the objectives of the consulting process is based on the generation of inputs that permit the identification of elements for developing learned lessons. In this sense, the consulting firm reached important conclusions, both for the evaluation of the implemented processes and for its effects. Some elements for discussion in favor of attaining the mentioned inputs are:

1. The project of Microenterprise development by means of renewable energy in the *El Quiché* region covers different technical aspects of community participation and organization and project management, which does not permit the specialization of its intervention in the field of renewable energy. The efforts for reaching an adequate level of community organization provide the expected results. This represents a high investment of time and resources, which is financed by the Global Environmental Fund as part of the incremental costs of the project making its benefits evident, which justified the investment.
2. The macro objective of the project must not be overlooked. It encompasses the development of microenterprises. The field evaluation permitted to demonstrate that the initiatives that have been developed to this date do not open short and mid-term expectations for implementing microenterprises basically because of two reasons:
 - 2.1 The first one is due to the implementation of photovoltaic lighting systems, which in its current size regarding the supply of electric energy has a use limited to lighting, with the possibility of being extended to the use of radios and 12V television sets.
 - 2.2 The micro-hydroelectrical plant is implemented for providing lighting, which in turn implies the possibility of using home appliances. Additionally, foreseeing the need of having an impact in the economic situation of the families, three-phase energy is introduced in more than 80% of the households⁶. This opens new possibilities for extending the use to microenterprise development (cardamom drying, coffee roasting and grinding, garlic dehydration, etc.).

These expectations of creating microenterprises for the benefit of community dwellers have discouraged some of the interviewees, since the project started a long time ago and the objective of providing energy has not been reached. Part of the problem is the meager participation of the municipality, which has become the greatest obstacle of the project.

3. It is extremely important to consider different management levels in which the high-level management of *Fundación Solar* takes part, especially when the actions include the participation of local authorities. In this sense, it is valuable to reach interinstitutional agreements, but municipal autonomy must not be overlooked in the decision-making process for the execution of projects in the communities that are part of the municipality.
4. The political issue is rather delicate, especially facing the inception of political proselytism activities in the country and when local authorities are part of the

⁶ The INDE expressed that the initial design of the project considered three-phase energy, although, after having started, other beneficiaries expressed interest, which meant extending the distribution grid, but with single-phase energy.

opposing party. The apolitical image of *Fundación Solar* must be given careful attention, which may be at risk if persons linked to the official party are permitted to participate in its management or actions. Specifically, the Department Representative, the Governor of the Department and the former mayor of Chajul.

5. The signing of agreements of technical cooperation as well as in technical assistance strategies, training and other activities aimed at strengthening local capacities and sustainability of the projects through time demand that follow-up outlines be established in order not to affect institutional credibility.

In the case that the actions carried out in the Reyna zone, Uspantán, it has been mentioned that the project is very useful for making health services efficient and extending their coverage. Notwithstanding, the failure to meet commitments was mentioned, as well as the low level of assistance provided by *Fundación Solar*.

X. RECOMMENDATIONS

1. The results that have been reached by the project do not include elements that permit a terminal evaluation since the effects on development and benefits that energy supply through a micro-hydro system can provide could not be measured. In this sense, it is **RECOMMENDED** to carry out an ex-post evaluation process using the same instruments with the objective of being able to measure the effect indicators that address the fundamental objectives of the project.
2. The implementation of the project in the village of Chel cannot be postponed any longer, basically because of the risk that having an infrastructure in place, but without providing the service entails. This has originated that some system accessories (plugs and some switches) in the homes of the beneficiaries are already damaged, even when their cost is relatively low and there are just a few cases.
3. The *Fundación Solar* must try to establish a dialog forum with the Mayor of Chajul because of the existing perception, both personally and at the municipal corporation. These frictions will have a short term effect with the ERIPAZ, key entity for the development of the initiatives for a full scale project. Up to this moment, there has been support from the Mayor for reestablishing cooperation, but he has expressed interest in having a high-level meeting.
4. The request of the Mayor of Chajul in the sense of giving preference in the payment of fees for beneficiaries who participated in the transportation of supplies (poles and bobbins) must be carefully analyzed, since this can put the project at risk.
5. It is important that, simultaneously to the community training programs in the areas of organization, self-management, and conflict resolution, training activities for the use of electric energy be provided, together with productive activities parallel to lighting. This and issues related to natural resources, such as their use, sustainable management and protection must be the emphasis of *Fundación Solar*. The outsourcing of services related to local development must be considered.
6. It is the opinion of the consulting firm that the *Fundación* should consider its contribution important giving preference to the implementation of renewable energy in the education and health sectors. With these two actions it would significantly contribute to the extension of the coverage at a national level. That is, if schools in rural areas, where it is possible to implement these projects, have a photovoltaic lighting system the possibility of increasing the coverage of literacy is higher. *Fundación Solar* has been able to witness this in the communities of Pa'l and Santa Clara.

In the health area, strengthening the cold chain for health centers or Minimal Health Units would guarantee quality vaccines for the effective immunization of children, which would also bring an increase in coverage. The experience in the Reyna zone, Uspantán can be a good example and teaches lessons for future areas of intervention. The implementation of radio and/or telephone systems where the cold chains are in operation can facilitate the emergency cases and the response to more complicated cases of morbidity.

7. Social processes are dynamic and community-specific. The efforts made in trying to measure impact through statistical methods are an interesting practice. However, in this context it is not always possible to reach the desired results, which could be analyzed by ethnological methods that can make important contributions to the understanding of social dynamics.

8. The renewable energy experience in Chajul is crucial for understanding organizational and participative dynamics regarding the issue of renewable energy. It could be very enriching to carry out two types of analyses: 1) statistical studies exclusively for the part of renewable energy and 2) an ethnological and qualitative study that could contribute much more insight regarding information on social aspects.
9. If *Fundación Solar* has the intention of continuing to work in the Ixil area and Uspantán for replicating the experiences of Phase I (PME) it would be very positive to open a Technical Office in the area, since this would aid in giving immediate attention to contingencies that could arise within the framework of the renewable energy projects.
10. The fact that *Fundación Solar* and municipal authorities manage to establish an organized work plan that includes timetables and assigned tasks can be extremely important for the parties and a periodical and horizontal communication between high-ranking authorities (mayors and authorities of *Fundación Solar*) could be attained.

IX. APPENDIXES

1. Instruments for data capture
2. Organization of variables according to indicator
3. Weight of variables
4. List of persons and institutions consulted
5. Output flow for frequency distribution
6. Consultants involved in evaluation
7. Output flow for Chi Square test

VISITED INSTITUTIONS

United Nations Development Programme
Nina Saalimaa, Programme Official

Fundación Solar:
Mario Hernández, Project Coordinator

Quiché Program, European Union
Roberto Rea, European co-responsible, Infrastructure Unit
Renzo Benincasi, European Co-director
Carlos Argueta Donis, National Co-director

Instituto Nacional de Electrificación

Ministry of the Environment and Natural Resources

Ministry of Energy and Mines

Ixil, FONAPAZ, European Union Program
Juan Clemente Raymundo, National Co-director

National Hospital of Uspantán and Health Centers of the Reyna Zone
Carlos Eduardo Recinos
Miguel Angel Arango
Julio Nova

CONSULTANTS INVOLVED IN THE EVALUATION

Productividad y Desarrollo employed personnel with a high level of experience in the areas of community development, project evaluation and follow-up, collection of field data, as well as in working with statistical tools. The number and type of consultants is described below:

1. A coordinator, expert in Project design, follow-up and control with more than 10 years experience, who was in charge of the verification of the quality of the products obtained, as well as the induction of the personnel involved with data collection.
2. A field director, with broad experience in development and evaluation processes, who was responsible for the validation of instruments, training of pollsters and conducting the data capture process, database design and refining of information obtained in the interviews and surveys.
3. A consultant in statistics, who facilitated the process of typing the survey results and carry out the proposed analyses (frequency distribution, chi square, and a non-parametric variance analysis for the selected indicators.
4. A consultant in energy and environment who offered support in the pertinence in the design of indicators related with these aspects, as well as in the framework of the reports.
5. Four Maya-speaking pollsters, who carried out the survey with members of the target groups.