



UNDP Project Document

REPUBLIC OF GUATEMALA

Productive Uses of Renewable Energy in Guatemala (PURE) PIMS No. 3186 (ATLAS Proposal N.00043790-Project N. 00051216)

Summary:

This project aims at removing barriers to the adoption of renewable energy technologies (RETs), mainly mini/micro hydropower (MHP), by promoting productive uses of energy in one of Guatemala's poorest areas: the departments of Alta Verapaz, Baja Verapaz, Quiché, Huehuetenango, and San Marcos. The project will create new local jobs and sources of income, while directly mitigating over 1.75 million tons and indirectly mitigating 5.25 million tons of CO₂-equivalent over 20 years. This will be achieved through the promotion of RETs that are linked to income generation and productivity enhancement that adds value to local agricultural cultivation. The sustainability of the productive uses will be enhanced through the application of adaptation mechanisms that address natural resource management and vulnerability issues where projects are developed, by providing the necessary structural support to relevant policy making and regulations, and by supporting national and local multi-stakeholder dialogue for long-term collaboration. The total required budget for this venture, which is complementary to ongoing Government of Guatemala efforts on poverty reduction, rural development and promotion of watershed management activities, is estimated at US\$ 12.67 million, with US\$ 2.55 million solicited from the GEF to cover incremental costs.

Project outcomes are fourfold and will focus on 1) the identification and development of productive uses of renewable energy that will directly and indirectly benefit poor rural dwellers through employment generation and added purchasing power, 2) the development of grid connected generation projects and off-grid projects, which generate at least 15 MW of renewable energy, 3) sustainable use of natural and energy resources and vulnerability reduction through integrated watershed management across 7 sites; and 4) the promotion of a sound legal, institutional and regulatory framework with the Government of Guatemala for the removal of barriers that currently thwart independent grid-connected power production as well as the off-grid application of renewable energy technologies.

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ACRONYMS

| | |
|-----------------|--|
| AGEXPORT | Association of Exporters |
| AGER | National Association of Renewable Energy Producers |
| AGER | Association of Rural Entrepreneurs |
| ANACAFE | National Coffee Association |
| APR-PIR | annual project report – project implementation review |
| BANRURAL | Rural Development Bank |
| CAFTA | Central American Free Trade Agreement |
| CDRO | Cooperation for the Rural Development of the West |
| CNEE | National Commission on Electricity |
| CO | Country Office (UNDP) |
| COCODES | Community Development Council |
| COMODES | Municipal Development Council |
| CONAP | National Commission of Protected Areas |
| CONRED | National Council for Disaster Reduction |
| DGE | Directorate General for Energy |
| ECLAC | Economic Commission for Latin America and the Caribbean |
| ESMAP | Energy Sector Management Programme |
| FCG | Guatemalan Trust Fund for the Environment |
| FONAPAZ | National Trust Fund for Peace |
| FONACON | National Fund for Conservation |
| FOGUAMA | National Fund for the Environment |
| FONAPAZ | National Trust Fund for Peace |
| FUNCAFE | Foundation for Coffee Development |
| FUNDAP | Foundation for the Development of the Highlands |
| IFAD | International Fund for Agricultural Development |
| INAB | National Institute of Forestry |
| GDP | Gross Domestic Product |
| GEF | Global Environmental Facility |
| GHG | greenhouse gas |
| GoG | Government of Guatemala |
| GVEP | Global Village Energy Partnership |
| IADB | Inter-American Development Bank |
| INDE | National Institute for Electrification |
| INFOM | National Institute of Municipal Development |
| IW | inception workshop |
| M&E | monitoring and evaluation |
| MAGA | Ministry of Agriculture, Livestock and Food |
| MARN | Ministry of Environment and Natural Resources |
| MAYACERT | Certifying Agency of Organic Products |
| MEM | Ministry of Energy and Mines |
| MHP | mini/micro hydropower |
| MSP | medium-sized project (GEF) |
| NREL | National Renewable Energy Laboratory |
| OLADE | Latin American Organization for Energy |
| OLAPE | Local organization for management of renewable energy projects |
| PINFOR | Forestry Incentives Programme |
| PPP | Plan Puebla Panamá |
| PUE | productive uses of energy |
| PV | photovoltaic |
| RCU | Regional Coordinating Unit (UNDP -GEF) |
| RE | renewable energy |
| RET | renewable energy technology |
| SEGEPLAN | Secretariat of Planning and Programming |
| UNDP | United Nations Development Program |
| UNFCCC | United Nations Framework Convention on Climate Change |
| URL | Rafael Landívar University |
| VAT | value-added tax |
| WB | World Bank |
| WWF | World Wildlife Fund |

SECTION A. ELABORATION OF THE NARRATIVE

1. SITUATION ANALYSIS

1. This chapter provides an overview of the context and significance of the PURE project in the first two paragraphs. The second paragraphs presents the analysis of the problems and barriers to interlink rural and energy development based on renewable energy technology in the baseline and expected trends.

1.1 Context and global significance

Geographical and socio-economic context

2. The project focal area, the north-eastern and north-western regions of the country, coincides with the war-torn departments of Alta Verapaz, Baja Verapaz, El Quiché, Huehuetenango and San Marcos, where 29% of the country's population is located¹. The project focal area covers approximately 32,020 km² and borders on its northwestern flanks with Mexico. The population of this area is mainly of Maya origin, including the following ethnic groups: Q'anjob'al, Jakalteko, Chuj, Mam, Ixil, Q'eqchi', Poqomam, K'iche' and Kaqchikel, all of whose first language is one other than Spanish. The population mix is both ethnically and politically heterogeneous as the region is home to returnees from Mexico as well as to former civil defense patrols. Post-conflict concerns are therefore an issue in terms of dialogue and participation, and also because of the war's effects on the demographic curve in the region, which shows a significantly larger percentage of elder population, widows, and young infants compared to middle aged men. Therefore, the efforts stated in this project proposal are linked to the commitment of the Guatemalan Peace Accords of activating income-generating programs and projects taking into account cultural as well as environmental issues.
3. Participatory needs assessments conducted by Fundación Solar (2000-2004) among 92 communities of this region revealed that the average daily income per family stands at US\$ 1 per day or approximately 230 quetzals per month, placing the region under the extreme poverty line². The local economy is mainly based on agriculture with maize as the dominant crop for subsistence. Other crops include beans, coffee, cardamom and some vegetables. On the livestock side, there is swine and poultry raising and a limited number of cattle herding. Of the participating departments, Baja Verapaz, Huehuetenango, and Alta Verapaz are among the top four departments in the country with the highest proportion of land apt for forestry production. Three of the participating departments, Alta Verapaz, Quiché and Huehuetenango, are high capacity water catchments.
4. Presently, 64% of the electricity generated in Guatemala is fossil fuel based, with the remaining 36% accountable to large hydroelectric and geothermal generation. Primary energy production is characterized by a heavy reliance on firewood, which accounted for 49% of primary energy final consumption in 2003³. While forest coverage is about 31% of the country, continuous growth in energy demand and vulnerability of firewood availability indicate the need for substantial energy supply diversification efforts. Guatemala has a hydroelectric potential of 10,000 MW, of which as much as 5,000 MW may be developed as small-scale hydro⁴ projects with minimal environmental

¹ *Censo poblacional 2000* (Instituto Nacional de Estadística, 2002).

² *Diagnóstico Socio-económico del Quiché* (Fundación Solar, 2000) and *Diagnóstico Socio-económico de la Franja Transversal del Norte* (Fundación Solar, 2001)

³ *Incentivos para el Desarrollo de Proyectos de Energías Renovables* (Ministerio de Energía y Minas, 2003)

⁴ The definition of *small-scale* varies in the international literature, but includes 'small hydropower' (< 15-30 megawatts, MW), mini hydro (< 3 MW), micro hydro (< 300 kilowatt, kW) and pico hydro (< 1 kW)

impacts⁵. The country is currently using only 11% of this potential. Guatemala has a geothermal potential of 1000 MW, of which it is using only 3%. Wind energy resources amount to about 200 MW of which no development has been made. Solar resources are abundant, with a 5 kWh per square meter/day average radiation.

5. The energy consumption patterns in the project's proposed area of work are well under the national average. Current grid coverage in the area, i.e., the five departments mentioned above, is 71%, but coverage in rural areas only amounts to 50%. The main energy sources are kerosene lamps and candles for illumination, and firewood for cooking. Women, because of their traditional roles, are most vulnerable to the effects of smoke, due to open fire cooking practices, and to prolonged periods of collecting fuel, due to increased firewood scarcity. Some communities also rely on diesel generating sets to provide basic lighting and power needs, including processing of some of their agricultural products. It is important to note that people that have no electricity service spend up to US\$ 6-8 (more than those who have access to the national grid, village mini-grids or even stand-alone PV systems) on inferior sources of illumination. Moreover, a participatory needs assessment carried out in 2000 by Fundación Solar showed that households below the poverty line (mostly indigenous) spend around 40% of their total income on these inferior energy sources; in other words, the poorer the people the higher their proportional spending on energy⁶. With regards to the renewable energy potential in the selected departments for electricity generation, there is small-scale hydro potential and abundant solar radiation.

Global environment context

6. According to Guatemala's First National Communication to the UNFCCC⁷, 7.5 million tons of CO₂ were emitted in 1990. Of this total amount, the energy sector contributed 3.7 million tons of CO₂. A climate scenario developed in 2000 shows that the per capita electricity consumption will have increased to a rate of 9% annually by 2010 and that greenhouse gas emissions in the energy sector will have raised accordingly. For 2010, CO₂ emissions from the energy sector will have risen to 13.8 million tons, four times as much as base line year amounts. In 2004, 65% of the total energy generated in the country was produced from fossil fuels. This is indicative of a national trend that is consistent with what happened in Latin America after the privatization and liberalization of the energy markets, from the early 1990s onwards, namely that Latin America has been moving towards higher fossil fuel dependence rather than developing their (large and small-scale) hydroelectric power. This change of trends has resulted in increased greenhouse gas emissions.
7. In terms of forest land related to firewood consumption, it is important to note that Guatemala's energy balance shows that firewood was contributing 49% of the primary domestic energy production, revealing that the energy balance structure in terms of the primary energy composition has not changed over the past 50 years. Furthermore, when taking into account the CO₂ emissions, Guatemala reported 13.5 million tons of CO₂ emitted in the base year 1990, in which firewood represented almost 4 times as much as all the emissions from fossil fuel burning. Guatemala is therefore interested in promoting the sustainable use of renewable energy sources, both traditional and new, to mitigate the effects of climate change.

⁵ *Energía en Guatemala*, prepared for the National Secretariat on Strategic Analysis of the Government of Guatemala (by Iván Azurdia Bravo, 2004)

⁶ *Estudio Socioeconómico para El Quiché* (Fundación Solar, 2002).

⁷ *Primera Comunicación Nacional de Cambio Climático* (MARN, 2001)

1.2 Threats, root causes and barrier analysis

Problem description and barrier analysis

8. The agricultural and agro-industrial sectors play a central role in the economy of Guatemala. These sectors are characterized by inefficient and inadequate energy use, mainly of oil-based fuels, traditional biomass and animal and human energies. This reduces productivity, increases production costs and leads to environmental and human health problems that add stress to agriculture, to the natural resource base and to society. Despite the availability of natural resources and the existence of technologies to tap their energy potential, as in most of the developing world, the widespread adoption of renewable energy for productive uses has not been achieved in rural Guatemala. Main reasons for this problem are the poverty trap, which does not enable low-income, often indigenous, people to invest capital upfront, and the failure of government assistance to incorporate new communities into a market economy (through productive uses of energy). While off-grid renewable energy has the potential to fulfill the energy needs of each of the steps in the agricultural production systems, the widespread application of these technologies is currently hampered by a number of barriers that are listed in Table 1. The combination of these barriers maintain a business-as-usual situation in which rural communities do not have the financial capability to access energy and other basic services, while lack of energy and other infrastructure severely limit the development of new income-generating productive activities.

Box 1 Gender, indigenous groups and multi-cultural issues

The UNDP Guatemala Office recently commissioned a study entitled "Gender gaps in non-agricultural employment considering interethnic differences in rural Guatemala" (by Julia Johannsen, 2004). One of the major findings of this research document indicates that although agriculture continues to represent the main economic sector in rural areas, the non-agricultural sector is growing in terms of income generation and employment and is helping to reduce financial risk, promote equality between the genders and ensure resource conservation within the family unit. It is estimated that over 70% of all rural women work outside agriculture with statistics showing that women in Guatemala are 46% more likely to work outside agriculture than men if all variables remain constant. The study also reveals though that we should distinguish between indigenous groups also, e.g., among the Mam and Q'eqchi there is a greater involvement in agriculture vis-à-vis K'iches and Kaqchikeles who are more heavily involved in commerce.

The above is important to mention in the context of the spill-over effects that will be generated among small and micro-enterprises, thanks to new energy services. The population in this post-conflict area is vulnerable because of the high proportion of widows and orphans. Consequently, women may be more involved and managing small business as their income sources. Apart from developing renewable energy services, the agricultural development of the products that yield added value to the local economy is a prime focus in PURE, but this should not hide the fact that development of other businesses and services is equally important to rural development, especially in the context of gender and development.

The target villages of the PURE project are all in areas that are mostly inhabited by indigenous Maya groups, all of whose first language is one other than Spanish. The prioritization and selection of villages is based on multi-cultural criteria, community needs, technical aspects (such as water resource availability) and potential for the development of productive uses (selection criteria are summarized in Annex B of Section D). PURE follows a participatory approach, aiming engaging the indigenous target communities from the onset in each phase of the three project development (i.e., identification/feasibility, investment and post-investment/operational) so that communities are empowered to take ownership. This implies (1) involving a large range of actors in the indigenous communities in the decision-making process, not only local authorities and development councils (CONCODEs) but also traditional and other groups of organization (indigenous, religious, farmers and women's groups) as well as local committees and NGOs, (2) capacity building of community leaders (from the mentioned formal and informal groups) and (3) awareness creation amongst beneficiaries and, if necessary, (4) setting up local structures in which the community and beneficiaries themselves manage the hydropower facility (e.g., electricity cooperative) and productive use development (e.g., association of coffee growers).

Table 1 Barriers to on-grid and off-grid RETs

| Energy technology | Main barrier | Barrier removal in GEF project |
|---|---|--|
| <i>Technology:</i> Grid-connected RETs - small hydro <i>Energy provider</i> - (Energy) enterprise <i>Type of finance:</i> - Equity (provider) - Loan (bank) | <i>Social-institutional</i> - Inadequate benefit sharing arrangements between private investors and local communities for natural resources management - Cultural gap between policy-makers/service providers and local population - Limited institutional mechanisms for conflict resolution and stakeholder participation | Output 3.1 Output 2.3 |
| | <i>Policy-regulatory</i> - Lack of regulations for incorporating RETs as IPPs, creating an uneven playing field for on-grid RET-based projects | Output 2.1 Output 4.2 |
| | <i>Market and financial</i> - Private investors do not perceive economic benefits in providing electricity access to rural communities. - Low income rural communities do not have enough income or energy demand to justify energy investments | Output 2.1 Output 2.2 Output 2.3 |
| <i>Technology:</i> Off-grid power - mini hydro - micro hydro - solar PV - solar thermal <i>Energy provider:</i> - (Energy) enterprise - Municipality - Community - End user <i>Type of finance:</i> - Equity (enterprise or end-user) - Loan (financial intermediary) - Grant (government, municipality, donor) | <i>Technical</i> - Deficient technical support by vendors and suppliers for implementing RETs in the rural context | Output 1.5 |
| | <i>Social-institutional</i> - Cultural gap between policy-makers and local population | Output 3.1 Output 1.4 |
| | <i>Capacity & knowledge</i> - Weakness in linking productive uses, micro-enterprises management, energy supply, and finance, contributing to a continuation of the cycle of lack of structured support for PUE - Weak links of energy development (hydro) and natural resources management (land, water, forest) at community and national planning - Lack of interdisciplinary expertise to work simultaneously on both rural energy and productive uses - Lack of expertise at community level in small business management | Output 3.1 Output 3.2 Output 1.4 |
| | <i>Market and financial</i> - Off-grid RET-based energy supply is not linked with income generation and (micro-)finance, creating a problem with sustainability of off-grid projects - Lack of lending for micro-enterprises for RET and PUE - Weak access of 'value-added' products to (international) markets and high transaction cost for 'fair trade' or 'environmental certification' of products | Output 1.1 Output 1.2 Output 1.3 |
| | <i>Policy-regulatory</i> - Lack of monitoring tools for decision makers that make explicit the links between energy, income generation and natural resources and risk management in watershed areas - Separate planning of rural development and energy planning at local and national level and between levels of government - Rural energy policy, focusing on grid extension, lacks consistent framework and instruments to allow rural off-grid communities to access energy services | Output 4.1 Output 4.3 Output 4.4 |

- Regarding grid connected renewable energy, the lack of adequate multi-stakeholder arrangements has hampered the development of projects that benefit both private investors and the communities that own or use the water resources. To date, private investors have developed small hydro projects by purchasing the necessary land and providing energy directly to the grid, without taking into

consideration the needs of the surrounding communities. In many cases, these communities receive no electricity service despite their proximity to the energy source, since there are no incentives for project developers to extend the grid to these areas. Therefore, local stakeholders, mostly of Maya origin, have a negative perception of private investors, mostly Spanish speakers from the city, since the use of their resource by outsiders provides no local benefits and they have no say over how their resource is managed. As a result, many communities have blocked new project developments or hindered the operation of existing operations.

1.3 Institutional, sectoral and policy context

10. Guatemala ratified the UN Framework Convention on Climate Change (UNFCCC) in 1995. The first targeted effort to address UNFCCC priorities was the launch of Guatemala's First National Communication to the UNFCCC in 2001⁸, which established a GHG inventory and vulnerability identification issues. In Guatemala, the *Ministerio de Ambiente y Recursos Naturales* (MARN, Ministry of Environment and Natural Resources) coordinates the formulation, implementation, and follow up of the national environmental policies and programs. MARN is both the UNFCCC focal point and the GEF Operational Focal Point and provides follow up to all regional and international agreements regarding the UN environmental conventions. The proposed project is relevant to the MARN climate change policy, in particular to its efforts to develop a national mitigation plan and support the development of technologies that reduce GHG emissions, including renewable energy technologies (RETs).
11. The *Ministerio de Energía y Minas* (MEM, Ministry of Energy and Mines) formulates the energy policies and promotes the laws and bylaws that are required to promote sustainable energy approaches. The recently approved Law for the Development of Generation from Renewable Energy Resources⁹ provides an incentive of a 10-year tax holiday for developers, and allows the import of material and equipment for power plant construction exempt of import taxes and value added tax (VAT). The new law will contribute to leveling the playing field for renewable energies (RE) by enhancing the opportunities of independent, small-scale, producers and operators to enter the energy market. It is important to mention, however, that the overall effects of these structural reforms to the energy sector, as well as the privatization of energy development in rural areas are not yet fully understood. Guatemala, like other Latin American countries, has advanced in the privatization of its energy sector in the past ten years, but still needs to improve the instruments that account for both efficiency and equity issues.
12. Two other initiatives have a relation with the present proposal:
 - The above-mentioned power distribution by-law, guarantees a market for small-scale and renewable energy technologies (RETs) in places located in the periphery of the national interconnected system;
 - MEM is trying to reshape the Rural Electrification Trust Fund, funded in the past through the sale of assets of state-owned distribution companies. The Fund promoted conventional rural electrification through grid extension and brought electricity to 0.5 million rural households in 3 years, achieving a coverage of about 70% of the population, but still leaving an important fraction of society without electricity services, especially the isolated rural Mayan villages. Presently, the MEM and the National Institute of Electrification (*Instituto Nacional de Electrificación*, INDE) are in the process of procuring funding for a second phase of this rural electrification trust fund, trying this time to include not only conventional grid extension, but off-grid electrification with renewable energy resources as well. The PURE project will benefit the implementation of the second phase of the Fund through the design and field-testing of sustainable financial mechanisms.

⁸ *Primera Comunicación Nacional de Cambio Climático* (MARN, 2001)

⁹ *Ley de Incentivos para la Promoción de las Energías Renovables*, Decreto 52-2003 del Congreso de la República (October 30, 2003)

13. The Ministry of Energy and Mines (MEM) has entrusted Fundación Solar with the task of assisting the Government in developing these two initiatives. As the executing agency of this proposed project, Fundación Solar has provided essential inputs into power distribution by-law in conjunction with key stakeholders from the MEM, the *Asociación Nacional de Generadores de Energía Renovable* (AGER, the Association of Renewable Energy Producers) and Guatemala's regulatory body for electricity, the *Comisión Nacional de Energía Eléctrica* (CNEE). Similarly, Fundación Solar has been instructed by MEM to assist through a multi-stakeholder dialogue in the design of a rural energy policy that will include off-grid and renewable energy.
14. The Government's Poverty Reduction Strategy¹⁰ identified a geographical poverty belt that includes various departments of northwestern and northeastern Guatemala. These departments constitute the area of implementation of the proposed project, intersecting with the Government's new rural development policy that responds to the declined sustainability of small farms, whose owners face increased international competition for their products. Poverty alleviation, improved management of land and water resources and control of pollution from agricultural sources are stated as immediate rural priorities in the Strategy.
15. The Poverty Reduction Strategy recognizes that, instead of large-scale commodity production, Guatemala's highland agriculture should focus on the production of quality products for export. A system of certification of origin of agricultural and food products is under development by three key organizations, the Association of Exporters (*Asociación Gremial de Exportadores de Productos No Tradicionales*, AGEXPORT), Association of Rural Entrepreneurs (*Asociación Gremial del Empresariado Rural*, AGER) and the Rainforest Alliance (with support from USAID).
16. The Ministry of Agriculture, Livestock and Food (*Ministerio de Agricultura, Ganadería y Alimentación*, and MAGA) is in charge of implementing policies and projects in the areas of food security, livestock production and export of traditional and non-traditional land products. MAGA is beginning to promote organic agriculture through different programs, specifically for coffee, vanilla, and vegetables. This endeavor is being carried out in association with non-governmental and research organizations such as FUNRURAL-FUNCAFE (*Fundación para el Desarrollo Rural*), MAYACERT (the certifying agency for organic products), AGER and the *Instituto de Agricultura Recursos Naturales y Ambiente* (IARNA) of the *Universidad Rafael Landívar* (URL).
17. The municipal development councils (*Consejos Municipales de Desarrollo*, COMUDES) and the community development council (*Consejos Comunitarios de Desarrollo*, COCODES) represent the forums for implementing programs and projects at the local level. Set by the Law of Decentralization, these provide the mechanism that allows the involvement, participation and empowerment of local actors.

1.4 Stakeholder analysis

18. The main project participants and their roles is described as follows:

- *Fundación Solar*

Fundación Solar has, for several years, worked closely with international cooperation agencies in Guatemala (such as USAID, European Union, HIVOS, World Bank and UNDP). Fundación Solar has, among other projects, successfully implemented the UNDP/GEF medium-sized project (MSP) 'Renewable Energy Based Small Enterprise Development in El Quiché' as well as the project 'Development of Policy and Legal Framework for Rural Energy Services for the Promotion of Renewable Energy Technologies and Access to Energy for the Poor' and UNDP-funded activities under the Global Village Energy Partnership (GVEP). Fundación Solar collaborates closely with government ministries, such as MAGA, MERN, SEGEPLAN, MEM, the private sector, academia, community groups, and other NGOs. As Fundación Solar enjoys wide respect of different energy sector stakeholders as well as the development community, it has been able to facilitate processes

¹⁰ *Estrategia de Reducción de la Pobreza: El Camino de la Paz* (Gobierno de Guatemala, 2001)

that would have otherwise been very difficult to carry out. The implementation of the full -sized PURE project will build upon the know-how and experience of Fundación Solar has obtained during the implementation of the above-mentioned projects and processes.

- *SEGEPLAN (Secretaría de Planificación y Programación)* will play a key leading role as the focal point and chair of the GVEP Working Group that will function as Project Steering Committee for PURE.
 - *MAGA (Ministry of Agriculture)* has allocated USD 8.0 million to provide co-financing (see the co-financing letter in Section I) for renewable energy development associated with target groups that are engaged in agro forestry, farming, and agro processing activities through the project “National Program for Rural Development – First Phase: Western Region” (see Section G; the Project has a total budget of US\$ 48 million).
 - *MARN (Ministry of Environment and Natural Resources)* will work as the GEF focal point providing project oversight, especially in issues related to climate change, reducing environmental vulnerability, and watershed management best practices for natural resources utilization and protection.
 - *AGER (National Association of Private Developers of Renewable Energy)* will provide co-financing of US\$ 1 million for the development of renewable energy (linked with the development of productive and social uses of energy as well as watershed management). AGER will also be a key member in the multi-stakeholder dialogue that will be set in order to discuss policy.
 - *MEM (Ministry of Energy and Mines)* will play a role as member of the GVEP Working Group that will function as Project Steering Committee for PURE. MEM will also coordinate with INDE (the national power generation and transmission utility) to provide funding for mini-grid construction in off-grid systems. INDE also manages the Rural Electrification Trust Fund, and even though it is currently depleted, it is planned to be replenished with new funds for both grid extension and off-grid support.
 - *Municipal governments* can play a role as owner of the village mini-grid installation (municipal electrical utilities) or as supporters of grass-roots RE micro-enterprises. The concurrence of the municipal governments is key to ensure all the rights for the use of water resource in a given watershed. Local governments will also provide co-financing to pay for road improvement and civil works in the construction phase of a micro-hydro facility.
19. The PURE project will involve a wide range of stakeholders at local and national level. Promoting their continued participation in project activities is one of the first challenges of project design, and it needs to be continued throughout project implementation. Relevant local stakeholders include, apart from the main project partners:
- Allied with MAGA, INAB (forestry institute) and AGEXPORT (private sector export council for non-traditional products) will be supporting value-added chains in small and medium agro-businesses managed by Mayan indigenous populations in the same geographical areas as the PURE Project.
 - Allied with MARN, CONAP (National Council for Protected Areas), FONACON (National Conservation Fund), FOGUAMA (National Environmental Fund) will be in a position to capitalize key government interventions aimed at providing value to environmental services that the project eco-region will develop.
 - The private university URL (Universidad Rafael Landívar) has signed an MOU with Fundación Solar to create a training certification program associated with project activities to provide formal training and in-service training to project promoters and small business entrepreneurs.
 - The *Fideicomiso para la Conservación de Guatemala (FCG, Guatemalan Trust Fund for Environment)* has signed a MoU with Fundación Solar to leverage a micro-finance delivery

mechanism to assist demonstration of productive uses dissemination. Other domestic financing institutions, such as BANRURAL and rural credit cooperatives, will be involved as well.

- Current and potential energy users in the agricultural and agro-processing sectors and their organizations, in particular farmers and farmers' associations and cooperatives.
- Private actors and NGOs in the energy sector
- Other governmental institutions, such as SEGEPLAN, FIS, Ministry of Health, Ministry of Education and FONAPAZ
- Regional institutions and networks that can act as cooperation platforms, such as Economic Commission for Latin America and the Caribbean (ECLAC), Inter-American Development Bank (IADB), Latin American Energy Organization (OLADE), Latin American Rural Electrification Council (CLER)
- International financial institutions, bilateral development cooperation agencies active in the RET field, such as Japan, the European Union, the Netherlands, and USAID. In addition, some U.S. agencies and organizations have provided technical advice and support to Fundación Solar projects, such as Sandia National Laboratories, New Mexico State University and Winrock International.

1.5 Baseline Analysis

20. In the baseline scenario, the renewable energy potential in rural Guatemala will continue to be underdeveloped, with substantial implications for the indigenous communities, the national government, and the global environment. Fossil-fueled grid extension will continue to be the standard electrification approach of the government, at a large taxpayer cost and low coverage at the rural level. Development in off-grid and on-grid renewable energy in rural areas will remain very limited. Therefore, in the baseline scenario, the energy situation in rural Guatemala will continue to be characterized by the following aspects:
 - Indigenous communities will have no access to financial resources to develop their locally available renewable energy (RE) sources. Potential added-value activities stemming from access to energy will not be examined and implemented, thus limiting the return on investment in renewable energy. In this way, the inadequate access to affordable modern energy supply will continue to constrain productivity and hinder the improvement of living conditions.
 - Families will remain dependent on the use of inefficient technology (such as candles and batteries for lighting) as energy sources in rural communities or adopt fossil fuel based technologies (such as diesel generators).
 - Few government resources will be directed to RE investment, and the majority of available resources will be dedicated to grid extension. Private investment in renewable energy will not occur because (a) RE isolated and mini-grid systems are not perceived as an attractive investment, and (b) the regulatory and institutional arrangements allowing grid connected RE to be distributed are not in place.
 - The focus on grid coverage extension and diesel generators for off-grid electrification will delay investment in other forms of energy production, thus contribute to increasing greenhouse gas emissions from the energy sector;
21. The baseline course of action leads to negative global environmental impacts, as the main sources of energy, whether grid connected or isolated, will continue to rely on fossil fuel based sources. The consequences in terms of GHG emissions to the atmosphere are calculated in Section B, dealing with the incremental cost and logical framework analysis.
22. Table 1 summarizes the barriers preventing the widespread adoption of RETs in Guatemala. These barriers have been identified during the previous renewable energy interventions in the country, including the GEF MSP and the GVEP initiatives (discussed in the next paragraph). While those interventions have made substantial progress in removing barriers, this project builds upon these experiences and strengthens the productive aspects of energy use to reinforce the sustainability of RE investments.

2. PROJECT STRATEGY

23. This chapter describes the rationale, global and development objective, outcomes, outputs and indicative activities of the proposed project

2.1 Project rationale and policy conformity

Policy conformity

24. The proposed project fits into the GEF Focal Area of Climate Change and addresses its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the GEF framework of Strategic Priorities, the project fits squarely within CC-4, Productive Uses of Renewable Energy. Furthermore, the integration of watershed management arrangements to enhance sustainable natural resource management aligns this initiative with the Strategic Priority on Adaptation.

GEF alternative scenario

25. The fundamental concept is to promote renewable energy in communities where the value of local goods will be enhanced through productive uses. Most communities are mainly inhabited by people whose first language is a Mayan language rather than Spanish. The project will link local producers with national and global markets. This will secure additional income, thus alleviating poverty in these areas and providing financial resources to ensure the sustainability of the renewable energy initiatives. This is an innovative approach compared to the more traditional one where the main focus was on meeting basic energy needs only. Instead, energy becomes a fundamental input of an operational framework that catalyzes an added-value productive chain.
26. Existing barriers for the dissemination of productive uses (PUE) of energy generated by renewable energy technologies (RET) will be addressed by fostering a multi-stakeholder dialogue that steers inter-institutional cooperation to respond to demand-driven community needs for PUE. The executing agency will catalyze and coordinate agreements to materialize commitments to income generation activities that mitigate GHG emissions through renewable energy technologies. Also, the project will provide a set of tools for decision making, planning, implementation, and monitoring, to promote the sustainability of innovative options for natural resources management through targeted capacity building and stakeholder strengthening.
27. The project's strategy therefore integrates various dimensions: (i) *mitigation* of GHG emissions through promotion of renewable energy technologies (RET), being made financially and environmentally sustainable by promoting linkages with (ii) *income generation and productivity enhancement* through productive uses of energy, by incorporating (iii) *adaptation to climate change* considerations regarding vulnerability and natural resource management practices that are relevant to sustainable livelihoods at the community level, and by providing the necessary (iv) *support to relevant policy making* and regulations and to a national and local multi-stakeholder dialogue and long-term collaboration, that are required for successful replication of the project in the national context.
28. The alternative scenario to be achieved through the implementation of this project will be characterized by:
- Increased use of and knowledge about RE for productive uses in rural areas with a sufficient level of technical services, financial support and local stakeholder engagement to warrant a sustainable operation;
 - Well-functioning linkages with local, national and international markets that generate increased local income for productive uses of RE, including adequate market information and access as well as accessible financing mechanisms both for RE users, vendors and other market actors.
 - An enabling environment for RE for isolated and grid connected generation projects, with mechanisms that guarantee the evolution of policies to respond to new developments.

2.2 Project goal, objective, outcomes and outputs / activities

Project goal and objective

29. The global environmental objective (*project goal*) is to *reduce Guatemala's greenhouse gas emissions by promoting productive uses of renewable energy with strong rural development benefits*. Project implementation will result in a direct reduction of 1.75 million tons of CO₂ equivalent, and an indirect reduction of 5.25 million tons of CO₂ equivalent, over a 20 year lifespan, by replacing current and forecasted fossil fuel usage with renewable energy.

National and local benefits

30. The (development) *objective* is exploitation of indigenously available renewable energy resources integrated with environmentally sustainable development and poverty reduction in rural areas. Targeted developments are tentatively 13.5 MW of grid-connected small hydro plants and about 1.5 MW of off-grid energy production, mainly mini/micro hydropower.
31. Under the GEF-supported alternative scenario, the value added resulting from a 'productive use of energy (PUE)' program will contribute to sustainable development in rural areas, seeking to bring employment and other economic as well as social benefits to the rural population. The project will seek increased local benefits through two separate energy-related approaches:
- Shared benefits of locally produced and nationally sold (grid connected) renewable energy. For the private sector, first estimates indicate an internal rate of return close to 12% of implemented grid-connected small hydro projects;
 - Extension of the local production chain of processed export products/commodities, including organic coffee, cardamom and timber products, which are processed locally through drying, dehydrating, sawing and packing, using renewable energy as process input, with consequential added value to the local economy. The sustainable use of locally available water and energy resources for processing creates value added to local products and has the potential to provide communities with better sources of income and higher living standards.
32. At the community level, the financial benefits will stem from the provision of capital investment and working capital for productive uses development, which will be recovered in a three -year period using interest rates that are similar or slightly below market rates. In this scenario, proposed new marketing strategies for organic coffee, cardamom, certified timber and certain other cash crops, will go hand in hand with increasing agricultural productivity and the development of community enterprises.
33. As a spill-over impact of introducing RET-based energy infrastructure for development of productive uses, electric appliances will appear that currently are not used at the community level (for example, refrigerators and electric sowing machines). This will not only increase the quality and quantity of domestic-based energy service, but also will favor the further enhancement of 'informal sector' activities, such as restaurants and small workshops, and, as a third category will encourage the development of eco-tourism activities.

PDF-B PURE

34. The Full Size Project Proposal was approved by the GEF Council during the February 2005 Inter-Sessional Work Program. However, pending issues in the GEF Secretariat Review Sheet still need to be addressed prior to CEO Endorsement, including:
- Detailed coordination arrangements between the UNDP/GEF initiative and other projects described in the Executive Summary;
 - Market assessments that define the proposed additional income generated for end users of RETs as a result of productive uses;

- Business models for development of small and medium sized enterprises that profit from productive uses of renewable energy;
 - Clarification of financial sustainability of project (including delivery models for Renewable Energy that cover technology O&M and investment costs, as necessary);
 - Inclusion of monitoring of economic activity in project areas of intervention in M&E plan
35. It was decided to address these issues first through PDF B assistance for market studies and assessment in order to meet all requirements of CEO endorsement of the UNDP Project Document. Out of the originally approved GEF contribution of US\$ 2,650,000, the amount of US\$ 100,000 was made available by GEF for this 'PDF B' assistance. The following PDF B activities were implemented during the first half of 2006:
- Market assessments of products that generate additional income generation for end users and business models for small and medium enterprises that profit from productive uses of energy;
 - Development of financial sustainability of renewable energy projects, including delivery models for renewable energy services (covering investment and operation and maintenance cost);
 - Definition of coordination mechanisms with other GEF and non GEF funded projects
 - Preparation of the final UNDP Project Document (for CEO endorsement)
36. The PDF B case studies focused on the communities of Chel (organization and business plan for the local hydropower facility), Las Conchas (ecotourism), Seasir (coffee and sustainable timber production) and Jolom Ijix (cardamom) that are located in the Quiché and Alta Verapaz province. The major findings of the market assessment, business plans and cost-benefit analysis are summarized in the report 'Productive Uses of Renewable Energy (PURE) in Guatemala' which is attached as Annex D. Another output of the PDF B is this revised Project Document, including a detailed budget, new co-financing agreements, revised coordination arrangements with the co-funded activities and an updated M&E Plan

Outcome 1 **Development and promotion of 1.5 MW off-grid technologies for productive uses of energy (PUE)**

37. The use of energy for processing local products creates value added to the local economy by means of *processed agricultural and forestry export products/commodities (formal sector)*. As spill-over effects it provides *improved energy services for cottage and small enterprises (informal sector)* and *households and services* with better sources of income and higher living standards, as is detailed below.
38. *Coffee* and *cardamom* represent the most important cash crop in the region. The main coffee markets are in North America, Europe and Japan. Cardamom is a spice highly demanded in the Arab worlds and used as an additive to coffee, food products and perfume. In order to be sold commercially, the crops need proper processing and drying. Farmers process the crops locally or sell the harvested crop directly to intermediaries. Sometimes locally processed coffee has low quality due to inappropriate drying processes. The improved local processing of the crops (instead of selling the harvested or a substandard processed product to intermediaries) will generate additional income in the communities.
39. This requires modern energy inputs for improved processing (e.g., de-pulping, drying, and packaging). Apart from firewood for heating the air, diesel fuel is used in the drying process to drive fans that circulate the hot air. Appropriate renewable energy (RE) technologies for drying are electricity from MHP (replacing the diesel engine) and solar drying (replacing wood). The analysis in the PDF B phase (focusing on the areas of Seasir and Jolom Ijix) shows that using electricity from a village micro hydropower facility in the processing facility is competitive with using individual diesel engines or a mini-grid powered by a diesel generator. Applying solar driers will have the positive environmental impact of reducing the consumption of wood that may have been produced in an unsustainable way.

Table 2 Productive uses of renewable energy

| Enterprise/activity | Energy service | Baseline (current or alternative) energy use | Main RET focus in PURE |
|--|--|---|---|
| Agriculture, horticulture and animal husbandry Value added products PUE Coffee, cardamom and certified wood Spill-over PUE Maize, dairy products, surplus traditional crops and other non-traditional crops (tomatoes, pineapple, vanilla, honey) | Milling and processing | Diesel engine (fuel, electricity) | Electricity - micro and mini hydropower schemes |
| | Irrigation and water supply | Diesel pump | Electricity - micro and mini hydropower |
| | Sawmill and packing | Saw (diesel engine) | Electricity |
| | Drying | Heat from wood | Solar thermal - solar dryers |
| | Lighting | Dry-cell battery Electricity | Electricity - micro and mini hydropower, solar PV |
| Small & micro-enterprises; services Eco-tourism (eco-lodges) Spill-over PUE <i>Products</i> (baskets, ceramics, clothing, woodcraft, weaving and embroidering) <i>Workshops</i> (blacksmith, carpentry) Social uses of energy <i>Services</i> (restaurants and stores) <i>Non-productive uses</i> (households), <i>Public services</i> (education, community centers, health clinics, communication) | Lighting, appliances and workshop tools (saw, drill) | Electricity (diesel-based generator/grid, batteries) Manual power; candles | Electricity - micro and mini hydropower, solar PV (with high-efficiency light bulbs and energy-saving devices) |
| | Cooking and heating | Firewood, LPG | (Biomass residues) (Efficiency improvements) |
| | Refrigeration | | Electricity - micro and mini hydropower, solar PV |
| | Potable water | Hand pump | Hand pump or electricity - micro and mini hydropower, solar PV Rain water catchments |

Source: Fundación Solar

40. While over the past decades coffee is being dumped on world markets lowering market prices, at the same time some market segments seems to be willing to pay for organically grown premium-quality coffee through 'fair trade'. Farmer's associations or cooperatives qualify for fair trade certification. Guatemala also has made substantial advances towards certification of its coffee and cardamom as high value "organic" crops. Production of 'fair trade' and 'organic' products requires better agro-forestry practices and local capacity building in order to raise productivity without resorting to chemical external inputs. Thus, integration of micro hydropower (MHP) with solar or improved biomass coffee dryers to the productive chain has the potential to increase local incomes and produce a high quality crop that can be labeled as "green" and/or "fair trade" and be sold at a premium price in international markets.
41. *Certified wood products* – As with coffee, Guatemala is making advances in green certification of much of its timber. This requires that wood is produced in sustainable managed forests or in dedicated plantations. The analysis made in the PDF B activities (taking the Seasir area as a case study) shows that such a plantation, producing firewood and timber, can be a profitable business at the community level. Furthermore, introduction of modern energy carriers will allow the development of sawmills and carpentry shops to further process the timber, thus increasing the value added retained at the local level. As in the case of coffee, renewable energy technologies can be used on a competitive basis with diesel fueled technology for the pre-drying of high quality woods (so that it can be exported in optimal conditions) and the local processing of the wood in various wood products.

42. *Ecotourism* – Tourism is increasing in Guatemala. Most of the project sites are located in landscapes that can be developed as ecotourism facilities due to the presence of natural forests, protected areas, waterfalls and endemic species. The case study of the PDF B focused on the Las Conchas facility which is at a scenic location and having some elementary facilities for the ‘off-the-beaten-track’ tourists. Upgrading these facilities into of a small eco-resort and cottages should be a profitable business. To attract a wider range of tourists, the availability of electricity, e.g. provided by the local MHP station, is essential to provide for lighting, communication and electric appliances.
43. *Spillover effects* in the form of technologies that currently do not or hardly exist at the community level, such as lighting, refrigerators, electric sewing machines and other appliances, will appear once electricity is available, thus improving quantity and productivity of:
- *Productive uses*, such as handicrafts (wood crafts, ceramics, baskets, clothing) and local market products and services (small metal and wood workshops, restaurants, stores)
 - *Social uses*, such as domestic lighting and water supply.
44. This cluster of productive use of RE can be considered as a spillover effect of energy supply for the first cluster of PUE. It includes activities such as maize grinding, milling and processing, water pumping, irrigation and supply, lighting, cooking and heating in production of agricultural products for the local market and in a series of local ‘informal sector’ services such as stores, carpentry shops, or tailoring (see table 2 for more details). The PURE project will support these activities through micro-credits that are not based on guarantees that require collateral. Loans will be based on the income generated through the productive use of the equipment, and will not require that these entities register in the formal sector.
45. The case study analysis of the PDF B phase shows that micro hydropower (MHP) forms a most cost-effective option for energy supply in the target region, suited to the size and scale of investments that can be promoted for supplying energy services to these isolated areas for productive and social uses. Under PURE, micro-hydro installation will be installed to provide power to nearby communities in a mini-grid system. The hydroelectric facility will be set up as a locally managed legal entity, referred to as OLAPE (*organización local para el manejo de proyectos energéticos*), which can be owned by the community (association, cooperative), private entity, municipality, or a combination thereof (mixed capital).
46. The project will work together with project partners from the national Government (MEM, MARN, MAGA), the private sector (AGER) as well as with the strong participation of municipal governments and local communities to enhance synergies for implementation and demonstration of technologies and production methods. To ensure maximum synergies, capacity building under this component will be complemented with the Government (MAGA and INAB) training on natural resource transformation activities associated with the production of organic coffee and cardamom, certified woods, dried vegetable product processing and canning, etc.

Output 1.1 Integration of local ‘value added’ products into existing commercial marketing chains due to the introduction of RETs

47. This component is essential to ensure that added-value local products and services (coffee, cardamom, certified wood, and ecotourism) reach the prospective national and international clients. As a starting point, market studies will be conducted to define the expected commercial value of local products. In the case of premium coffee, cardamom and wood, this will include the identification and strengthening of market links with companies in the U.S, Europe, Japan and Central America and a marketing strategy that identifies commercialization chains in certified, fair trade or green seal goods. It is anticipated that the project may secure written agreements with at least three potentially interested companies as well as cooperative agreements with AGEXPRONT and AGER.

Activities¹¹:

- 1.1.1. Conduct assessment of existing local, regional and international markets for ‘value -added’ products;
- 1.1.2. Assessment of the link between energy, commercial activities and income generation in potential sites for implementation of mini hydro and other off-grid RETs;
- 1.1.3 Development of marketing plans for commercialization of ‘value added’ products;
- 1.1.4 Foster MoUs between community/rural enterprise producers and institutions at the market level.

Output 1.2 Development of 1.5 MW of off-grid electricity from micro hydro and solar

- 48. Based on the results of the earlier market studies and the productive uses strategy developed in Output 1.1, feasibility and energy demand studies will be conducted to ensure that the project provide an adequate energy service. Off grid project sites will therefore combine a substantial potential for the extension of value added productive chains, and availability of renewable energy resources to meet the projected energy demand. Around 7 micro hydro installations will be installed in the river basin communities, each providing power to the nearby communities in a mini-grid system (and, where necessary and possible, supplemented with solar PV for selected isolated applications and solar thermal for drying of products on farms). A list of sites that will be included in the PURE project is given in the Table 3. A more extensive description is given in Section D .
- 49. These off-grid project sites are selected based on the experience Fundación Solar with the before-mentioned UNDP/GEF MSP project in Quiché and the UNDP/GVEP-supported activities that have yielded a portfolio of renewable energy subprojects (mini/micro hydro sites) that allowed Fundación Solar to establish an implementation plan based on engineering designs of RETs that supply energy for productive uses. In addition to this, other important factors in the selection process are proper community organizational arrangements (including existing cooperatives or associations), local governance structures, existing infrastructure (such as roads), and national grid extension plans. A list of selection criteria is given in Annex of Section D of this document.
- 50. Arrangements will require efforts in evaluation of community reactions to investment in power generation, conflict resolution and new co-management schemes. Capacity building efforts will be led by the PURE project and MAGA staff. The implementation of the subprojects closely will be coordinated with all project stakeholders, including MAGA, INDE, and MARN as well as micro credit institutions and local stakeholders (municipalities, river basin committees, community organizations, etc) that will also provide the financing mix for the initial investment in equipment, civil works and construction.

Activities¹²:

- 1.2.1 Linked with 3.1.4 and 1.3.1, assessment of the state of development in the project area, analysis of potential villages and sites, establishment of a project portfolio of available hydro sites and other RETs (resource assessment and pre-feasibility analysis, linked with the user needs and productive uses of energy in the area) and development of specific criteria for selection of RET projects;
- 1.2.2 Selection of project sites and technology, based on consultation with communities, river basin committees (output 3.1), local enterprises, municipalities and/or government;

¹¹ Part of the activities 1.1.1, 1.1.2, and 1.1.3 were initiated during the P DF B (i.e., the market studies and business plans for coffee, cardamom, certified wood and ecotourism in the communities Chel, Seasir, Jolom Ijix and Las Conchas) and will continue in other communities during the implementation of the full -size PURE. A full description of the market studies and business plans for productive of energy at the above -mentioned four sites is given in Section D of this project document.

¹² Parts of the activities 1.2.1 -1.2.2 were initiated as part of the PDF B and co -funded activities.

Table 3 Portfolio of off-grid micro hydropower projects

| Project | Preparation stage | Beneficiaries | Capacity (kW) | Local organizations |
|--|-------------------|-----------------|---------------|---|
| Las Conchas (Chahal, Alta Verapaz) | (Pre-)feasibility | 303 households | 190 | Community council |
| Seasir (Cahabón, Alta Verapaz) | (Pre-)feasibility | 395 households | 90 | Community council |
| Jolom Ijix (Panzós, Alta Verapaz) | (Pre-)feasibility | 86 households | 60 | Cardamom association Community council |
| Sajsiban (Rio Ixtupil) | Pre-feasibility | 1431 households | 710 | Community council Municipality |
| La Vega (San Marcos) | Profile | 95 households | 60 | Community association Municipality |
| Batz'Chocolá (Nebaj) | Profile | 75 households | 30 | Community association Municipality |
| Linio Putul (Uspantán, Quiché) | Feasibility | 91 households | 10 | Municipal committee |
| Chel (Chajul, Quiché) | In construction | 440 households | 165 | Association |
| Unión 31 de Mayo (Uspantán, Quiché) | In construction | 405 households | 55 | Cooperative |
| Balanyá-Pfxcayá (Zaragoza, Chimaltenango) | Profile | | 55 | Cooperative |
| Guaxabaja (Purhá, Baja Verapaz) | Feasibility | 19 households | 55 | NGO; community council |
| TOTAL | | | 1,480 | |

Source: Fundación Solar (2006)

- 1.2.3 Development of feasibility studies and financial plans for the proposed subprojects, linked with social and productive uses analysis (as discussed under output 1.1) and environmental impact assessment (linked with output 3.1);
- 1.2.4 Definition and implementation of organizational arrangement of the RET subproject with the river basin committee, local community, cooperative or association, including ownership and management set-up, financial arrangements and tariff structure and stakeholder involvement;
- 1.2.5 Development of project specifications, contracting and bidding procedures ;
- 1.2.6 Call for bidding, evaluation of bidding and awarding of contracts;
- 1.2.7 Construction of RET subprojects at selected sites and communities ¹³ (*not financed with GEF funds*).

Output 1.3 Increased capital mobilization for PUE lending in the project area

- 51. With the private and the financial community, national banks, local rural development banks and local credit NGO's, GEF support will be sought in particular to build capacity to assess renewable energy projects used for productive uses in the context of small businesses and to approve urgently required lines of credit for working capital. Thus, capacity building with this target group will be closely linked to explaining the role of RE in their business plans and strategic investments as well as enhancing access to financial mechanisms for local communities. There will be a need to assess the applicability of a variety of micro-finance delivery mechanisms for productive uses, such as local micro-capital funds.
- 52. For the processing, drying and packaging of processed coffee a local entity will be established, such as a coffee producer associations or cooperative. To set up the entity and finance its initial investment

¹³ It is important to note that no GEF funds will be used to subsidize equipment – counterpart funding is earmarked for this purpose.

(machinery, civil works, raw materials, spare parts, human resources) a loan will be asked from a bank. Recently, the Government established the *Guate Invierte* support program (500 million quetzals) which acts as a guarantee fund for such loans for rural enterprises. Loans are disbursed through normal lending channels, but at preferential conditions (e.g., lower interest rates, 11% instead of 17%, and a 2-year grace period), while the fund guarantees the loan to the bank.

53. The hardware associated with the MHP stations will be financed by a mix of sources, i.e., grants, loans and community contributions¹⁴. When choosing financing modalities for RET and PUEs, special attention will be paid to the opportunities provided by regular financing channels of the agricultural and rural sector such as BANRURAL, the FCG and others, as well as to the financial schemes governing seed, fertilizer and other agricultural inputs.
54. One example of a financing scheme for a MHP mini-grid (for Chel, El Quiché) is given in the accompanying document of Section D. The example makes clear that financing of the hardware will in general come from a mix of sources (grants, loans, own contributions)
 - A contribution by GEF (for the feasibility and engineering analysis as well as training)
 - National government sources (MEM, MAGA, INDE, FONAPAZ) to cover the initial investment cost (installation and construction; civil works, electromechanical equipment)
 - Municipality and community (mostly an in-kind contribution in terms of infrastructure and civil works, such as road and land preparation)
 - End-users (in-kind, in terms of labor as well as cash in the form of tariff payments). Tariffs will be designed in such a way that they will not only cover operation and investment cost but allow for building up a reserve for re-investment needed for expansion or for major overhaul activities)¹⁵.

Activities:

- 1.3.1 Assessment of lending opportunities and current capacity of commercial and micro lending organizations;
- 1.3.2 Development of guidelines on micro-financing methodologies for PUE;
- 1.3.3 Training facilitation on lending for PUE for financial institutions and municipality and community members;
- 1.3.4 Identification of financial instruments for energy providers (enterprises, municipality, community), linked with business development and productive uses;
- 1.3.5 Definition and implementation of financial arrangements for PUEs (energy service and productivity improvement) with one or more financial institutions in the area;
- 1.3.6 Lending funds for productive uses machinery procurement (such as mills, refrigerators for dairy products, food production and processing equipment) as well as for RET procurement will be covered by the mechanisms included in this project (*but not by GEF funds*).

Output 1.4 Local capacity building and strengthened small and micro enterprises, based on PUE applications

55. As key factors for success, the project will design and catalyze the implementation of capacity building programs and financing schemes for the productive use of RE applications. Capacity building efforts will target:
 - Local technicians and small rural entrepreneurs at the community level,
 - Financial institution decision makers and private sector developers,
 - National and local Government agencies.

¹⁴ See also paragraph 2.6 in this section and Section D for more details on financial sustainability

¹⁵ Importantly, the development of productive uses is expected to boost demand, not only in the beneficiary community itself, but because the selected community will develop over time as a growth centre (offering shops, crop processing facilities and social services to the surrounding area, called 'micro-region'). Previous Fundación Solar efforts have demonstrated that in a five-year span, electricity demand increases from 7-11 kWh/month (when initially connected) to 30-50 kWh/month (once productive uses are being developed).

56. Specific program contents will be tailored to suit the needs and purposes of different target groups. Where technicians are concerned, the emphasis will be placed on developing their skills to install, operate and maintain new MHP equipment¹⁶, and helping them to train others in the project area. In the case of communities, the emphasis will be placed on enhancing farmer users' and vendors' skills to assess different production options, designing marketing strategies, and enhancing users capacity to benefit from the new equipment through training in green marketing or identification of trading partners and international markets, among others. Since most rural people will not speak Spanish (at least not as a first language), capacity building will take place in the local Mayan language, if and where appropriate. Decision makers will be trained in-service on the role of renewable energy associated to their project designs and poverty reduction strategies.

Activities:

- 1.4.1 Formulation of 'good practices' manual for off-grid MHP (and other RE) projects, including design, feasibility and cost analysis, tariff structure, links with productive uses, environmental impact assessment, stakeholder involvements and institutional-organizational aspects as well as containing lessons learnt from other projects;
- 1.4.2 Capacity building program on RETs for PUE for trainers on:
 - Operation, maintenance and administration of MHPs, based on 'good practices' manual (for private sector, NGOs, ministries, local municipalities and organizations),
 - Productive uses (new product development, micro-enterprise development, finance and management (for fieldworkers from Mayan communities);
- 1.4.3 Training and technical support for stakeholders (enterprise, community, municipality and/or individual end user) on:
 - Operation and maintenance of RETs and on energy enterprise management, based on 'good practices' manual (for private sector, NGOs, ministries, local municipalities and organizations),
 - Productive uses (new product development, micro-enterprise development and management (for fieldworkers from Mayan communities);
- 1.4.4 Based on 1.3.1, 1.4.2 and 1.4.3, develop business and financial plans for stimulating businesses involved in PUE development;
- 1.4.5 Provision of business incubator services for small and micro business, involved in PUE in selected communities and sites.

Output 1.5 Review of technology support system and commercialization of off-grid RETs

57. A study will identify barriers in technology infrastructure and support system problems with regard to the renewable energy industry, focusing on off-grid RET applications (quality and standardization, imports vs. local manufacture of systems and spare parts, skills development, local maintenance and repair facilities). In the study capacity building needs will be defined for RE companies that sell and distribute (part of the) RET equipment. The study will focus on mini/micro hydropower and to a lesser extent on solar PV and solar dryers. This assessment will review manufacturing, quality assurance, standards and code of practice, operation and maintenance, market development and promotion, and innovative financing mechanisms that supplement government subsidies and link productive end-uses.

Activities:

- 1.5.1 Assessment of the RET support system (maintenance and rural service centers, quality control and codes of practice, RET manufacturers' associations, consultants and support organizations) and commercialization of RETs (marketing, finance, manufacturing and quality control);
- 1.5.2 Identification of capacity gaps in RET support structure and definition and implementation of targeted capacity building program to improve the support system.

¹⁶ The focus will be on MHP, but where solar driers and PV will be included in the energy supply. local capacity building will be extended to these technologies as well

Outcome 2: Development of 13.5 MW and promotion of grid-connected RET (mini hydropower)

58. The Law for Incentives for the Development of Generation from Renewable Energy Sources (2003) will help level the playing field with thermal generation using fossil fuels, but a market niche for private sector energy development in rural areas has not really been developed yet. As much as 5,000 MW may potentially be developed in Guatemala as small-scale (mini/micro/small) hydroelectric projects with minimal environmental impacts. The project will work as broker between authorities, investors and local partners. About 13 mini hydroelectric subprojects will be developed as is indicated in Table 4.
59. A new interesting income generating opportunity for communities is the generation of electricity not for own consumption but for interconnection with and sale to the national grid. For example, after having implemented the 160 kW micro hydropower station for the community's off-grid power demand, the Chel Hydroelectric Association (A.H.Ch.) is now exploring the possibility of developing a 1.4 MW on-grid mini hydropower station. Similarly, in the community of Tacaná, three local organizations (one association, one cooperative and a social club) have joined forces with the local government to raise capital for the development of a 1.8-5 MW on-grid mini hydropower scheme.
60. An important barrier that independent hydropower producers often face is the rural people's negative perception towards hydro development and long term degradation of the watershed that provides water to the hydro facility¹⁷. In terms of the watershed management, which is an essential insurance for any hydro developer, agreements will be established between the local government, the private developer and the community groups to manage the watershed in a way that water springs are protected and the rest of the watershed is managed and used in a sustainable way. Furthermore, cooperation among stakeholders will also focus on connection of the surrounding community to the MHP and on increasing the value of products such as coffee, cardamom, certified woods and services, such as ecotourism, thus inducing a value to the watershed's natural resources that can compensate for the protection and long-term availability of water in any given site¹⁸. The project will therefore bridge the existing divide between private investors and municipal authorities, often urban Spanish speaking, and rural, mostly Mayan, communities by ensuring that investment benefits are shared in a fair way between stakeholders. This will be achieved by the provision of energy services to local communities, the promotion of rural development through PUE, and the definition of adequate arrangements for sustainable resource management. It is important to note that the renewable energy association AGER has committed US\$ 1 million to support the development of PUE in communities linked to their investment.

¹⁷ The level of tension between hydro developers and local Mayan communities has risen to such a level that, in several cases, private investment is no longer feasible due to community dissatisfaction (expressed through road blockages, disruption of water supply, etc). Furthermore, working in rural areas where land and access to water are a priority to local dwellers, the establishment of clear property rights and resource sharing arrangements are essential for any investment. Therefore, private investors have realized that, in order for their investment to be protected in the medium and long term, these conflicts must be addressed. While, on a strict financial basis, provision of electricity to these communities is not a priority, the private sector acknowledges that corporate social responsibility must be factored into the investment costs, and is therefore willing to contribute to the rural electrification effort.

¹⁸ The on-grid projects are typically larger than micro hydropower (termed mini hydropower < 3 MW) and developed by a private developer or local entity. Here, the issue is environmental protection (watershed management) and 'social responsibility'. The basic idea is that 'water resources' are not free, but that the environmental cost has to be internalized. Current practice is that developers usually support the surrounding communities with infrastructural works (school, clinics, clean water) in order to get approval by the municipality to go ahead with the project, but do so in an *ad-hoc* way. Here the GEF contribution aims at developing some framework of guidelines and rules not only for infrastructural works, but for environmental protection (see Outcome 3) and for compensating communities by means of developing productive uses.

Table 4 Portfolio of on-grid mini hydropower projects

| Project | Preparation stage | Beneficiaries | Capacity (kW) | Local organizations |
|---------------------------------------|--------------------------|--|---------------|--------------------------------------|
| Chaxá (Chajul, Quiché) | Feasibility | Community (265 households) and grid - connection | 1,852 | Multi-service association (ADIM CPR) |
| Santa Avelina (Chajul, Quiché) | feasibility | Community (1455 HH) and grid-connection | 1,113 | Community council Municipality |
| Tacanán (San Marcos) | Feasibility of expansion | Community (2,500 HH) and grid-connection | 1,800 | Municipality and ADITA |
| Chel II (Chajul, Quiché) | Proposal | Interconnection | 1,400 | A.H.Ch |
| Chajul (Chajul, Quiché) | Proposal | Communities (Pal, Xeputul) and grid | 700 | ADIM Municipality |
| Iztapil II (Rio Iztupil, Sotzil) | Proposal | Communities (Sotxil, Ilom) and grid-connection | 600 | Community council Municipality |
| Cotzal I (San Juan Cotzal, Quiché) | Proposal | Community (San Felipe) and grid-connection | 865 | Community council Municipality |
| Ximula I (San Juan Cotzal, Quiché) | Proposal | Community (Chichel) and grid-connection | 750 | Community council Municipality |
| Ximula II (San Juan Cotzal, Quiché) | Proposal | Community (Sta. Avalinal) and grid-connection | 500 | Community council Municipality |
| Tzicuary (San Juan Cotzal, Quiché) | Proposal | Community (Vichemal) and grid-connection | 300 | Community council Municipality |
| Chipal (San Juan Cotzal, Quiché) | Proposal | Community (Las Hortensias) and grid - connection | 350 | Community council Municipality |
| Cotzal II (Xeputul, Cotzal) | Proposal | | 1,200 | Community council Municipality |
| La Castalia (Rio Naranjo, San Marcos) | Profile | | 2,000 | Municipal utility |
| TOTAL | | | 13,430 | |

Source: Fundación Solar (2006)

Output 2.1 Development of 13.5 MW of hydropower, connected to the grid and to surrounding communities

61. The project's assistance will focus on choosing the appropriate institutional and implementation mechanisms, such as commissioning, BOT (build, operate and transfer), facility licensing and joint ventures (between municipal government and the private sector) that allow development, financing, construction, and operation of at least four small hydropower installations.

Activities:

- 2.1.1 Establishment of final project portfolio and pre-feasibility analysis over small hydropower sites, using already developed project portfolio;
- 2.1.2 Design of 'good practices' manual, incorporating stakeholder involvement modalities, management and institutional aspects and environmental 'good practices' and distribution of the manual among relevant stakeholders;
- 2.1.3 Training in various sessions of small hydropower development practitioners in the technical aspects (design, building and operation), cost-benefit analysis and financial management, ownership and institutional issues, with emphasis on addressing community needs and cultural sensitivities, conflict transformation through stakeholder engagement and environmental aspects;
- 2.1.4 Identification of 13 sites for grid-connected power to be included in the GEF project (*not financed with GEF funds*);

- 2.1.5 Development of feasibility studies and business plans, including financial, organization-institutional setup, stakeholder involvement plan and environmental impact assessment
- 2.1.6 Financial closure for project implementation and MoU between private sector investors and other local or regional partners¹⁹ (*not financed with GEF funds*);
- 2.1.7 Construction of at least 4 projects (*not financed with GEF funds*).

Output 2.2 Productive uses of energy catalyze rural development in communities associated with RE investment

62. As part of the sharing of benefits promoted by this project, and in addition to job opportunities provided through the construction, operation and maintenance of the hydro plants, the capacity of the rural Mayan communities to develop productive chains through PUE will be strengthened. Since the on grid RE investments will occur in the same region as the off grid projects, much of the work outlined in Outputs 1.1, 1.3, and 1.4 will be applicable for these communities. While energy supply characteristics may be different, the premise is that all communities in this area share the need for energy as a fundamental input for economic and social development. Therefore, support will be provided to promote agricultural and spillover productive uses, small business development, and access to finance. Support for such initiatives will be co-funded by project funds, AGER, and MAGA.

Activities:

- 2.2.1 Assessment of productive uses potential and associated energy needs, including linkages to local, national, and international market studies (similar to activities in Output 1.1);
- 2.2.2 Assessment of financing opportunities, including micro financing methodologies, and development of financial arrangements for productive uses of energy (associated with the activities developed under Output 1.3);
- 2.2.3 Strengthening of small businesses in beneficiary, mostly indigenous, communities, including capacity building for rural entrepreneurs, development of business and financial plans, and provision of business incubator services (associated with Output 1.4).

Output 2.3 Stakeholder engagement and implementation of environmental ‘good practices’ in small-scale hydro project development.

63. Emphasis will be placed on constituency building through the establishment of integrated river basin committees and development of management and annual operational plans. Such issues as conflict resolution over natural resources, land tenure insecurity, long term strategic planning, gender issues and communications between up-stream and down-stream dwellers will all be addressed in these new forums. The river basin management plans in this area will contain a provision of supporting the development of productive uses of energy, by providing credit accessibility and technical assistance for PUE access. Financing will be provided by the project with co-financing from private sector developers.

Activities:

- 2.3.1 Training in various sessions of small hydropower development practitioners in the technical aspects (design, building and operation), cost-benefit analysis and financial management, ownership and institutional issues, with emphasis on addressing community needs and cultural sensitivities, conflict transformation through stakeholder engagement and environmental aspects;
- 2.3.2 Site-specific assessment of stakeholder issues and development of strategy for stakeholder engagement;

¹⁹ In terms of the financial contribution, AGER has committed US\$ 1 million that will accompany the investment in 13.5 MW of grid connected RE. Since the rate per kWh will be equal to that of any other grid connected user, the only remaining input to connect users to the grid is the local distribution grid and metering devices. The Ministry of Energy will finance these inputs with funds from their grid extension budget.

- 2.3.3 Negotiation and enacting of agreement between stakeholders to develop a project, including credit accessibility and technical assistance for PUE access, as well as incentives to attract people around sites being developed to support the project construction;
- 2.3.4 Monitoring of the agreements during project implementation.

Outcome 3: Sustainable natural and energy resources management in river basins

- 64. Integrated river basin management helps to reduce the risks to climate related events, including severe droughts or floods that may in turn cause a series of disasters in the form of landslides and result in huge socio-economic losses to already vulnerable populations. The sustainability of the hydroelectric investment directly depends on adequate upstream watershed management practices. Unsustainable practices lead to problems (such as excessive sedimentation, lack of regular water flow, etc) that will have a direct effect on the capacity to generate electricity and must therefore be mitigated. This will require actors to be brought together not just within the context of political or administrative boundaries but also based on natural geographic units or river basins. It will also help ensure the long-term supply of freshwater resources and ecosystem management. Besides securing a constant supply of freshwater and electricity, integrated river basin management will help to provide a number of other environmental goods and services to local communities, including food sources, timber and medicinal plants, soil erosion control and climatic vulnerability measures.
- 65. The PURE project will therefore take an integral approach to integrate vulnerability (e.g., based on food security and climate-linked disasters, such as flooding and droughts) with the management of natural resources in the watersheds where off-grid and on-grid hydropower projects are developed²⁰. These issues are to be addressed through decentralized water management at a watershed level by adapting and applying the model developed by Fundación Solar in Rio El Naranjo watershed (department of San Marcos). This model consists of integrating into a river basin management committee not only the political authorities but also grassroots organizations that have interest in different aspects of water use (potable water, irrigation, sanitation, fisheries, energy, etc.). PURE will use as much as possible already established mechanisms for local participation, such as the COCODES and COMUDES, as coordinating bodies to avoid creating new entities and to induce leverage from other development activities.
- 66. With GEF funding covering the incremental costs associated with establishing the appropriate social and environmental conditions for sound renewable applications, the PURE project will leverage support from MAGA (as well as CONAP and INAB) to be allocated exclusively for complementary integrated river basin management activities, such as building capacity to promote more appropriate land use management practices. This outcome is concurrent to MARN's climate change policy, particularly to its efforts to develop a national platform related to health, food security and natural resources. Strong coordination at national level will be complemented with collaboration with MAGA's National Program for Rural Development, the GEF funded project "Capacity Building for Adaptation stage III" and also the PERZA²¹ initiative in Nicaragua of which one UNDP component on watershed management is being implemented today. Cross sharing among these projects will allow drawing lessons and improving this particular aspect in the PURE initiative.

Output 3.1 Local enabling environments for participatory watershed management, integrated with natural resources management for RE generation and vulnerability aspects

- 67. In order to manage risk and reduce vulnerability from climate variability, this initiative has identified a strong need for integrated river basin management. New tools and techniques²² for the incorporation of

²⁰ The Strategic Priority on Adaptation allows GEF funding for adaptation -related activities as long as projects demonstrate global environmental benefits. The activities proposed in Outcome 3 are designed to reduce vulnerability to climate variations through adequate watershed management arrangements.

²¹ World Bank/UNDP/GEF Project *Nicaragua: Off-Grid Rural Electrification for Development (PERZA)*

²² One innovative idea is 'payment for environmental services'. Dutch -supported forestry projects in Guatemala have experimented with using a small percentage of the profit of generated by private or community forestry and

the climate-change-related issues of mitigation (energy production and consumption), adaptation and vulnerability into natural resources management in watersheds require the strengthening of stakeholders. First, local policy makers and NGOs need to be acquainted with new paradigms and tools. Second, better natural resources and risk management practices will be implemented through a participatory and inclusive approach, taking into account the local culture, gender and political aspects.

68. The PURE project will subcontract organizations, experienced in conservation and river basin management, such as *Fundación Defensores de la Naturaleza* and the *Universidad Rafael Landívar*, to a) work closely with MAGA and municipalities to catalyze local constituency building processes that lead towards watershed management and b) to carry out an assessment of natural resources management and practices in agriculture and forestry. Vulnerability assessments will include valuation of climate-linked risks and disasters, such as droughts, hurricanes and floods, and definition of response strategies, including analysis of freshwater threats, cover of high-conservation-value forests and disaster response measures. The project will provide the necessary assistance to legally establish stakeholder committees for the integrated management of land and water at the watershed level and for the development of river basin management and operational plans. Ideally, these should be linked with local environmental and land-use planning and prioritization, i.e. ecological and economic zoning conducted together with local dwellers in select micro watersheds. This will allow for the delimitation of specific areas for different purposes according to their environmental fragility, and consequently improve or maintain soil and water conservation, minimize pollution levels, and reduce soil nutrient loss that impinge on freshwater resources and habitats.

Activities:

- 3.1.1 Raise awareness among main actors at the institutional level regarding watershed management, climate change adaptation and vulnerability issues, linked with the development of hydropower (and other RETs); dissemination of methodologies and tools on integrated watershed and natural resources management, linked with RE generation and adaptation;
- 3.1.2 Development of local stakeholder dialogue on issues related to watershed management, vulnerability and climate-related disasters in approximately 7 areas that including the proposed project on-grid and off-grid RE sites;
- 3.1.3 Assessment of climate-linked vulnerability, current natural resource management (NRM) practices and local capacities to respond to climate-related emergencies in the 7 micro-river basin areas;
- 3.1.4 Identification and organization of local watershed committees in about 7 sites
- 3.1.5 Assessment of financial schemes to support integrated watershed management practices, including but not limited to “payment for environmental services” schemes;
- 3.1.6 Drafting of integrated river basin plans for natural resources management and disaster response, tailored to local needs and promote participation among both men and women (according to WWF guidelines²³).

horticulture activities for watershed management, for example, forest management, and reforestation and agroforestry activities (referred to as PINFOR *Programa de Incentivos Forestales* or PINFRUTA). Within PURE, it will be investigated if this concept can be extended to ‘PINERGIA’, in which a small percentage of the tariff proceeds (0.2%) will be used by the community for watershed protection activities. Also, the possibility to use carbon credits, generated by hydropower projects, for watershed management activities will be explored.

²³ Seven WWF guiding principles for effective integrated river basin management are: (i) developing a long-term vision, (ii) integration at the policy and institutional level, (iii) decision-making at the river basin scale, (iv) timing to meet urgent and more long-term needs, (v) participation among all stakeholders in planning and decision making, (vi) adequate human capacity building and awareness raising of all participants (vii) and knowledge based on scientific data for sound and adaptive management that responds to both human and ecosystem needs.

Output 3.2 Better management practices for agricultural, agro-forestry, forestry and animal husbandry

69. The sustainable forestry business is directly linked to appropriate management of watersheds, because it helps protect the water resource and ensure the necessary energy potential, as well as adding value to natural resources that are currently grossly undervalued. The Government's poverty reduction strategy focuses on improved management of land, water and forest resources, and control of pollution from agricultural lands, by establishing better practices in forestry, agriculture, agro-forestry and animal husbandry. Thus, the project will coordinate and cooperate with MAGA and the IFAD-MAGA National Program for Rural Development on capacity development at the grassroots level directly related to the management of natural resources linked with energy supply.
70. For example, many agricultural processes are currently inefficient due to the lack of an adequate source of energy. On the other hand, provision of energy alone will not solve the problem unless agricultural and forestry processes are improved (in view of the producing high quality 'value added' products for international markets). Where effective, traditional agricultural practices of the Mayan communities will be systematized and combined with modern high-tech options, and will be applied in environmentally degraded areas to promote agro-forestry best management practices. This will be achieved through farmer-to-farmer exchange visits, communications campaigns and on-site demonstration practices. Information exchange and dissemination will be conducted in novel ways that make good use of traditional communication mechanisms, mainly conducted in evening gatherings. The project will also promote the participation of older members of the indigenous community who may share their knowledge with the younger generations. In this way, participatory stakeholder involvement will ensure the long-term operation of the PUE applications (outcome 2) by providing raw materials from the watershed in an environmentally sustainable way.

Activities:

- 3.2.1 Training/workshops for and dialogue between community, local producers and local NGOs dialogue on sustainable natural resources management, sustainable energy, conflict management techniques and vulnerability reduction;
- 3.2.2 Implementation of better management agricultural, forestry, agro forestry and animal husbandry practices in at least 20 micro-river basins (including the PURE project's off-grid and on-grid RET sites);
- 3.2.3 Monitoring and participatory evaluation of the introduction of better natural resources utilization and agricultural and forestry practices.

Outcome 4: Conditions for project replication are established (including policy and regulatory proposals); monitoring, learning and evaluation

71. The project will establish an implement a system for monitoring and evaluating results, based on the logical framework given in Section B of this project document. Specific indicators linked to productive uses of energy will be analyzed and refined as necessary. Results and impacts of project activities will be measured and shared through workshops and publications. The monitoring strategy will include a continuous feedback mechanism that maintains the project team aware of project implementation performance. Data on energy use and technologies and the impacts of PUE will be collected during project implementation²⁴. The project management team will be required to demonstrate adaptive management skills to adjust the project strategy as necessary.
72. In order to ensure replication, the project will also propose specific policy measures and regulations that support the use of RETs for both on grid and off grid energy uses. While the proposed policy

²⁴ E.g., project impacts include number and capacity of RETs installed; number of households and social services affected; income generated and expansion of businesses; improvement of awareness on RETs among end users, NGOs and technology providers; policy development regarding rural energy supply with RETs; increase of financing availability and mechanisms for RE and PUE; expansion of supporting services for RE

inputs are not essential for the investments included in this initiative, they are vital to ensure a) a level playing field for independent, small scale grid connected generation with RETs, and b) continued government assistance for cost-effective off-grid electrification with RETs.

Output 4.1 Monitoring, learning, feedback and evaluation

73. Best practices experience gathered in the field as part of the activities of outcome 1, 2 and 3, will result in a monitoring tool for small and mini hydropower development, productive uses of energy, and income generation at the local level.

Activities:

- 4.1.1 Establishment of a project performance and impact monitoring tool with indicators and verifiers to gather project-relevant information; baseline study, monitoring and evaluation of results and impacts
- 4.1.2 Refinement of project information and documentation on RET and PUE experiences and lessons learnt²⁵. Development of case studies on energy, productive uses and income generation, linked with vulnerability and adaptation aspects;
- 4.1.3 Application of IPCC recommendations to estimate carbon sequestration related benefits of the PURE initiative;
- 4.1.4 Dissemination of innovative approaches, lessons learnt and good practices to local stakeholders and stakeholders at national and local level;
- 4.1.5 Formulation of a strategy to extend PUE activities in Guatemala after the PURE project's end.

Output 4.2 Proposal of regulatory instruments that create an adequate enabling environment for independent small-scale hydropower generation

74. In conjunction with key stakeholders, the project aims to use the results of project outcome 2 to develop further the regulatory and financial instruments under the new Law for Incentives for the Development of Generation from Renewable Energy Sources that promote independent grid-connected production of renewable energy for the private sector.

Activities:

- 4.2.1 Assessment of tariff, regulatory, taxation and legal issues regulatory regarding grid-connected independent power production by the private sector;
- 4.2.2 Policy dialogue between private developers, government and other main stakeholders;
- 4.2.3 Drafting of proposal for RET-based regulatory approaches and instruments and lobby for approval.

Output 4.3 Proposed policy directives on off-grid rural energy provision with small-scale hydropower and solar energy

75. The on-the-ground efforts in PURE, conducted closely with INDE, SEGEPLAN, MEM, MARN and MAGA, will ensure that a coherent policy framework is proposed to Congress and key decision makers in the Government to promote renewable energy technology for off-grid rural electrification and remove existing barriers to its implementation. After the reform and privatization of the electricity sub sector, the Government created a Rural Electrification Trust Fund with the idea of advancing new connections of rural dwellers. Unfortunately, the Fund has been depleted, but will be replenishment for a second phase, once a loan has been negotiated with Unión Fenosa (the private power distribution company that distributes energy) matched with MEM-INDE funds. This is an ideal point in time for PURE to lobby for the enhancement of the Fund to include off-grid electrification support. This will also be commented upon by civil society through multi-stakeholder round table dialogue groups. In setting up such a multiple stakeholder approach, the project will build on the experience and lessons

²⁵ Part of this activity was initiated under the PDF B, resulting in the current revised project document

learned from the UNDP/GEF MSP project in El Quiché and other UNDP-supported energy projects implemented in Guatemala.

Activities:

- 4.3.1 Development of basic principles of policy development for off-grid energy supply, linked with existing plans of grid extension;
- 4.3.2 Assessment of policy instruments related to increased off-grid energy services and rural development, including:
 - ‘Smart’ subsidy mechanisms and rural energy funds for off-grid energy supply and involving local banks and other credit facilities (promotion of loans and micro-credit, by providing credit guarantee and insurance),
 - Implementation of efficient financial (non-grant) mechanisms that encourage larger-scale RE employment, involvement of local banks and micro-finance institutions as intermediaries (loans, micro credit, guarantee, insurance) and private sector and community organizations as beneficiaries;
- 4.3.3 Formulation of a policy document on sustainable energy and PUE through multi-stakeholder dialogue guided by CNEE, INDE and/or MEM and organized through the GVEP Steering Committee (see paragraph 3.2) with the participation of, e.g., MARN, MAGA, CONAP, INAB, SEGEPLAN, CNEE, MEM, INDE, EEGSA, Unión Fenosa and URL.

Output 4.4 Improved policy dialogue on the linkages between energy supply, rural development, natural resources management and climate-change adaptation

- 76. Through its involvement in PURE, MARN is in a good position to closely monitor what works and does not work in terms of poverty alleviation and vulnerability reduction due to climate variability. A risk prevention and vulnerability mitigation strategy will be developed by the MARN, based on the project results, as part of its commitment to the UNFCCC National Communications. This strategic development exercise will be developed in consensus with the environmental conservation sector, developers and other policy makers and is anticipated to have broader impacts throughout Guatemala at the river basin level.

Activities:

- 4.4.1 Preparation of an agenda of policy issues;
- 4.4.2 Assessment of a sector-wide approach to rural energy, adaptation, development and donor coordination, to avoid duplication and to effect synergy;
- 4.4.3 Convene a multi-stakeholder dialogue on how provision of RETs and off-grid energy services to productive uses can help reduce poverty and enhance environmentally sustainable development.

2.3 Project indicators, risks and assumptions

- 77. Key indicators of success for the Project include:

Energy and climate change:

- Multi-sectoral investment in RE technology with increased private sector involvement in on-grid and off-grid projects;
- Farmers and agro-processing associations/cooperatives’ adoption in the project’s area of RET applications for productive uses;
- Adaptation of RE and enhanced energy efficiency to the local context through the demonstration of potential agricultural/agro-industrial uses of the technology;
- Increased capacity to assess and manage risks associated with long term climate change through an integrated watershed management approach.

Institutional:

- An enabling legal, regulatory and policy environment, adopted by the Government of Guatemala (GoG), with consolidated policies and regulation for promoting grid-connected RET as well as off-grid RET in rural areas;
- Adoption of "rules of the game" by the private sector and the Government in the promotion and development of RE (price policies, regulations, norms, green certification; fair trade; forestry and agro-processing);
- Strengthened river basin committees and strengthened institutional cooperation between agricultural/agro-processing and energy sectors in the rural areas, mostly inhabited by Mayan language speakers;
- Strengthened capacities of stakeholders in identifying, designing, promoting, marketing, investing, installing, operating and maintaining RE in agricultural/agro forestry production systems;
- Strengthened markets of RE applications in Guatemala.

Environmental:

- Avoided GHG emissions from (future) energy use in the communities in the project area and reduced dependence in the national power grid on fossil fuel based technologies. Direct reduction in GHG emissions of 1.75 million tons of CO₂;
- Watershed management plans implemented at local level;
- Improved agricultural practices by local communities.

Economic and social:

- A considerably increased financial flow towards productive use RE projects in the selected municipalities;
- Enhanced income generation and employment in rural, mostly indigenous, communities, due to enhanced markets for goods produced by RETs and increase in small and medium business development;
- Enhanced food security in the poor rural areas of the project sites;
- Social and spill-over benefits resulting from increased availability of energy for domestic and micro-enterprise productive uses;
- Contribution to sustainable rural livelihoods and poverty alleviation in rural communities (which are mostly inhabited by Mayan language speakers).

Awareness, knowledge and dissemination:

- Increased awareness of and information about RE for productive uses in the rural sector in Guatemala;
- Dissemination of project results in other municipalities of Guatemala.

78. Important project assumptions are:

- Baseline is not superseded because of larger volumes of energy imported from the interconnected neighboring countries or due to a decrease in fossil fuel price;
- Long-term financial support and pro-active participation of the GoG and its institutions, in particular MEM, MARN, MAGA as well as of local governments;
- National economic conditions and regional integration (CAFTA) favor income-generating investments for RETs for PUE in rural areas;
- Political stability allows cooperation between ministries and with non-government stakeholders as well as local democratic governance structures;
- Active interest of local (indigenous and non-indigenous) communities to participate in managing water and land resources, enabling energy development for productive uses;

- Potential conflicts between municipalities, communities and private developers regarding shared watersheds and land tenure can be minimized.
79. During the project design stage, project risks have been closely analyzed and mitigation strategies have been incorporated. However, while the project is designed to minimize these risks, some issues are not entirely within the project's control but may affect project implementation. These risks are listed below.
80. *Social participatory:*
- Political unrest due to unmet social demands affects community participatory processes;
 - Divided leadership, social fragmentation and weakened business climate that has prevailed beyond the civil war period in the highlands area continues to pose a barrier for investment and lending in this area. Fundación Solar has a long experience in operating with these type of communities (indigenous and/or civil war returnees) and thus will directly address this issue in the project. However, the fragility of social structures in this area introduces a level of risk that cannot be completely eliminated.
81. *Policy-regulatory, institutional:*
- Political changes shift government priorities to other areas than the project's objectives. The execution of the project by Fundación Solar minimizes this risk; however, active engagement by government counterparts is essential to achieve project objectives;
 - MEM/INDE contributions may be severely affected by the continuous subsidy to existing users in grid-connected Guatemala, limiting their investment capacity in off grid electrification and thus impeding underserved populations from receiving focused subsidy for accessing energy services. While financing for the direct interventions in the PURE project is secured, the sustained contribution of government financial resources for off grid electrification is essential. To minimize this risk, the project will contribute to efforts that promote such financing as part of its replication strategy;
 - MAGA remains committed to reduction of vulnerability in selected watersheds. Given the current level of support channeled through MAGA to address this issue, this risk is considered minimal.
82. *Market and financial:*
- Due to remote location of some potential project sites, sustainable products sources and resources may be difficult to supply and access to financing for remote communities difficult. Criteria for project selection sites will include these aspects to minimize the risk. However, after nearly three decades of energy sector deregulations, a rising concern relates to equity and rural development in relation with PRSPs and sustainable development. Hence the acknowledgment of adapted financing mechanisms where the Government plays a central role to develop these projects. The GOG, supported by the PURE initiative will take necessary measures to mitigate this risk;
 - AGER and private developer's interests to develop RET in the project's area may shift or diminish due to unclear regulatory frameworks with lack of incentives for RET development and/ or a drastic reduction in international oil prices (making RETs more expensive in comparison with conventional energy production). The project will continue to advance efforts by the MEM and Fundación Solar for an adequate RE investment enabling environment. Recent policy initiatives (such as the RE Incentive Law mentioned earlier) and the continuing high price of oil on the international market suggest that a policy reversal is unlikely;
 - Variations in market prices for targeted goods and commodities do not allow their financially sustainable production, impeding repayment of loans of RET for PUE investments. To minimize this risk, international markets for targeted products will be thoroughly assessed during project initiation. Furthermore, the project focuses on products that form the basis of the GoG's rural development strategy, thus ensuring broad support (from sources other than project funds) for such activities. For example, the project focuses on fair trade and organic coffee (as one of the productive uses) whose prices tend to be more stable on the markets than the price of ordinary coffee.

83. The project monitoring strategy will ensure that particular attention be devoted to measuring the above risks and “red flags” are raised in a timely manner. Should any of these risks (or other unpredicted events) jeopardize the project’s implementation, the project management team will be responsible for taking the appropriate measures, in consultation with the GVEP Steering Committee, to adapt the project strategy as necessary, with UNDP, UNDP/GEF support.

2.4 Expected global, national and local benefits

84. The total CO₂ reduction attributable to the proposed GEF initiative is 1.75 million tons of CO₂ over 20 years. Total GEF investment is US\$ 2.65 million; hence the unit abatement cost of the GEF intervention will be US\$ 1.50 per ton of CO₂.

2.5 Country ownership: country eligibility and country drivenness

85. Guatemala is eligible for GEF financing and has ratified UNFCCC on March 28th, 1995.
86. In Guatemala, MARN coordinates the formulation, implementation, and follow up of the national environmental policies and programs. MARN is both the UNFCCC focal point and the GEF Operational Focal Point and provides follow-up to all regional and international agreement regarding the UN environmental conventions. The proposed project is relevant to the MARN climate change policy, in particular to its efforts to develop a national mitigation plan and support the development of technologies that reduce GHG emissions, including RE technologies (RETs).
87. MEM formulates the energy policies and promotes the laws and bylaws that are required to promote sustainable energy approaches. The recently approved Law for the Development of Generation from RE Resources²⁶ provides an incentive of a 10-year tax holiday for developers, and allows the import of material and equipment for power plant construction exempt of import taxes and value added tax (VAT). The new law will contribute to leveling the playing field RE by enhancing the opportunities of independent, small-scale, producers and operators to enter the energy market. However, the law has only recently been approved and a sound regulatory framework is yet to emerge in Guatemala.
88. The Government developed a poverty reduction strategy that identified a geographical poverty belt corresponding to the departments where the proposed project will be implemented. In this strategy, the Government established a new rural development policy in response to the weakening situation of small farmers, faced with increased international competition. Poverty alleviation, improved management of land and water resources and control of pollution from agricultural sources are stated as immediate rural priorities. It recognizes that, instead of large-scale commodity production, Guatemala’s highland agriculture should focus on quality products. A system of certification of origin of agricultural and food products is under development, and the GoG is pursuing full compliance with pesticide legislation and starting to promote organic agriculture. Land and water management issues are to be addressed through decentralized water management at the watershed level. MAGA is taking the lead in implementing this rural development strategy.
89. PURE responds to the Government’s rural development priorities by promoting environment -friendly agricultural and agro forestry practices, rational use of natural resources and poverty alleviation. The project will build on a concerted effort among public, private as well as NGOs and local partners to reach the above goals. Furthermore, the combined cash and in-kind contribution of the GoG (MAGA), local government (municipalities) and the private sector (AGER) is a very clear expression of interest for a project that is a combination of public-private investments.

²⁶ *Ley de Incentivos para la Promoción de las Energías Renovables* , Decreto 52-2003 del Congreso de la República (October 30, 2003)

2.6 Sustainability and replicability

Sustainability

90. Income-generating productive uses of renewable energy are the foundation for the sustainability of the proposed initiative. Renewable energy sources will be developed in regions where a value added productive chain has been identified and corresponding income generation has been quantified. Additional income generated at the local level will allow end users to pay for energy services, thus ensuring sufficient funds for adequate operation and maintenance services. The project will avoid the traditional malpractice of setting tariffs in off-grid systems that do not cover operation and maintenance (O&M) cost (let alone, part of the investment cost), often with detrimental effects for the system's reliability in the long run. The true success of this endeavor will imply that energy will be treated as a means responding to a productive and social demand, where energy is one of several key inputs such as credit accessibility, technical assistance, market development and administrative processes.
91. Integrated watershed management at a local level is a key component of project sustainability. Rivers and streams are basic in all aspects of rural community livelihoods, indigenous and non-indigenous. Therefore, the use of water as an energy source must be an integral component of watershed management practices. In this context, it is also important to enhance local capacities to reduce vulnerability to extreme climate events. The project, in association with MAGA, will explore methodologies for adequate local watershed management and risk reduction to ensure the sustainable use of the watershed. It is expected that at least 7-10 river basin management committees will be legally established by the end of the project.
92. Regarding grid-connected renewable energy production by private developers and local organizations, sustainability of essentially lies in simulating market mechanisms that allow the development of RET as an effective and least cost alternative for power production. This project will demonstrate the clear ownership and community participation from project's onset, in the application of conflict prevention and resolution methodologies, strong local government concurrence and support as well as the importance of strong partnerships between funding agencies and implementing agencies.
93. Institutionally, sustainability will be understood in this project as the ability to incorporate and institutionalize the concept of renewable energy as a means to integrated rural development into an inter-ministerial coordination unit that can carry economic or social programs incorporating energy from the beginning of the planning process. The GVEP concept will be carried over and strengthened to ensure continuity and the incorporation of fresh ideas into the future.
94. Financial sustainability must be addressed for the two different cases: off grid and on grid renewable energy:
 - *Off-grid:* The project acknowledges that an element of grant financing required making the investment feasible to the end user²⁷. The premise of this project is that the grant will only be provided for initial investment on equipment, and no subsidy will be provided for consumption. Hence, any user fee must cover, at least, life cycle O&M costs of the equipment and should allow for future overhaul and/or expansion (a detailed analysis of cost and financing of micro hydropower is given in the document of Section D. The MHP tariff should be seen in the light of the current estimated expenditure of US\$ 6-8 per month used for inferior technology, such as candles, kerosene lamps, and other low quality lighting sources (see also Section D for more details).
 - *On-grid:* For mini grids, energy consumption will be metered and billed at the around the standard grid is sufficient to cover O&M costs and to establish a reserve fund. Once connected to the grid, users will receive no additional subsidy for consumption and will pay the same "social tariff"

²⁷ Interested financiers include JICA (Las Conchas, Seasir, Jolom Ijix), HIVOS (Chaxá), local private investors (Tacaná), philanthropic organizations (Batz' Chicolá), EU/USAID/Sandia laboratories (Chel), Siembra/Islands Canarias (Unión 31 de Mayo), MAGA (Balanyá Pixcayá), TNC/DFN/Sandia (Guaxabajá), municipality San Marcos (La Castalia) and AGER (sites to be defined)

(currently at US\$ 0.12 per kWh) as any other grid-connected consumer that consumes less than 300kWh/month. The only element of subsidy that is present in this case is the financing of low tension distribution grids for the communities, which will be financed with government funds. PURE will focus on harnessing the productive potential of the electricity to ensure an adequate payment capacity in the recipient community.

Replicability

95. The replicability of the project hinges on the project's ability to clearly demonstrate the financial and social benefits of productive uses of renewable energy. The project strategy is to develop a win-win model where the income stream, generated through productive uses, provides benefits to both end users and electricity producers through the increased payment capacity, in which the end-users have clear commitments and willingness to pay tariffs needed for a long-term maintenance, operation and expansion of the RET installations. Thus, the PURE project will focus on developing and facilitating new mechanisms that allow other stakeholders to invest in renewable energy, rather than rely entirely on financing with government or donor grants.
96. PURE will work to convince the Government of Guatemala that a financial delivery mechanism should be set in place in the second phase of the Government's Rural Electrification Fund for subsidizing access to rural energy services and for providing loans and credits for productive uses of energy. Rural off-grid electrification is generally not financially feasible, so subsidies should be used to allow universal access to a modern energy supply. However, the system can be made economically viable, if the subsidies are used in a 'smart' way that does not create distortions between users of isolated systems and grid-connected users, by re-directing tariff subsidies (for electricity consumption) to credits for off-grid and RET-based technologies for productive uses in a way that generates income, creates jobs and steers economic development.
97. Regarding grid-connected renewable energy production, replicability will be ensured by establishing adequate mechanisms of benefit sharing among project stakeholders, thus fostering investment in financially viable RE based generation. The project will also support the establishment of a regulatory framework within the Law of Incentives for Renewable Energy, which is expected to catalyze further interest and investment in renewable energy by independent private developers.
98. These mechanisms will be applicable to Guatemala as a whole, therefore establishing a national framework for project replicability. The relevant ministries, MEM, MAGA and MARN, have shown a strong commitment to the promoting RET and PUE, recognizing their great value to foster local employment and development as well as sustainable natural resources management. The local capacity built in projects partners will allow the continuation of an integral rural development approach, where energy will not be seen as an end, but as a means to foster economic growth and social services. The participation of grass root groups from the indigenous communities, municipal government, national government agencies and private sector will create a critical mass of constituency to support renewable energy and its productive uses. This will enable the continuation of financial and assistance programs based on demand and experience gain during project implementation.
99. The ultimate objective of the project is to mainstream successful project experiences into the operations of the private sector and the Government of Guatemala. In addition to the linkages to the development initiatives mentioned in this proposal, the PURE project be scaled up within the context of the Ministry of Environment's program known as "*Guate Verde*" (Green Guatemala)²⁸, which seeks to mainstream environmental issues into the Government of Guatemala's broader socio-economic reactivation plan coined "*Vamos Guatemala*". In particular, *Guate Verde* strives to promote the development of economic clusters, such as forestry or tourism, through the adoption of better management practices and new ways of doing business, including the use of clean and efficient energy

²⁸ Officially launched by the President of Guatemala, in January 2005, *Guate Verde* reflects the commitment on the part of the GoG to promote economic growth and market-based competition in a sustainable and equitable fashion by ensuring that environmental concerns are taken into account. This program complements the other three "pillars" of *Vamos Guatemala* - these being: "*Guate Compete*" (Guatemala Competes), "*Guate Crece*" (Guatemala Grows) and "*Guate Solidaria*" (Social Guatemala).

sources. The Ministry of Environment (MARN) is currently in the process of implementing this program nation-wide, among local governments and civil society, and projects such as the PURE will represent key vehicles through which to execute this agenda. In turn, projects such as PURE will also represent novel and concrete experiences that the government will seek to replicate in other regions of the country within the umbrella framework of this strategic program.

100. Finally, the replication of project results will be promoted through active dissemination of project results and lessons learned. PURE will actively work on information dissemination and public awareness enhancement activities, in the form of public exhibitions, multi-media presentations, dissemination of public information, and conduct of training courses, seminars and workshops.

3. PROJECT MANAGEMENT ARRANGEMENTS

3.1 Links with other initiatives

101. The proposed PURE project will build on efforts carried out through other UNDP energy programs and initiatives in Guatemala, incorporating lessons learned and needs identified during their implementation. These initiatives include:

102. *Renewable Energy Based Small Enterprise Development in the Quiché Region*, UNDP/GEF Medium Sized Project (1999-2002).

Budget: USD 781,000 (GEF: USD 383,000, co-financing: USD 373,000). Executed by Fundacion Solar.

The goal of this medium sized project (MSP) was to promote the formation of small renewable energy enterprises with innovative financing and social organization schemes in order to provide basic electricity services to off-grid areas and developing productive uses. During execution, the MSP attracted additional funding for a small-scale hydro plant in one community within a conflict area and the installation of solar PV panels. The final evaluation report of the MSP rated positively elements, such as local participation, inter-institutional cooperation and capacity building, but also indicated that the limitation in size and duration of projects such as the MSP makes them insufficient to reach the objectives of established innovative financing schemes and functioning renewable energy service enterprises. However, the MSP confirms Fundacion Solar's capability to execute the envisaged full-scale PURE project (see Box 2 for more details).

103. *Development of Policy and Legal Frameworks for Rural Energy Services for the Promotion of Renewable Energy technologies (RETs) and Access to Energy for the Poor*, UNDP project (2003-2004).

Budget: USD 230,000 with co-funding of USD 336,600 mobilized (European Community, USAID, Fondo de Inversión Social). Executed by Fundacion Solar.

This UNDP-funded initiative helped to advance a multi-stakeholder dialogue that has produced the Law of Incentives for Renewable Energy. The initiative has linked the policy dialogue with project implementation by means of training of energy project developers and formulation of a portfolio of small and mini hydro projects, which will be used in the PURE project.

104. *GVEP Guatemala: Energy for Poverty Reduction, Phase I*, UNDP project (2004-2005).

Budget: USD 100,000

The Global Village Energy Partnership (GVEP), which was launched by UNDP and the World Bank at the 2002 World Summit on Sustainable Development (WSSD), held in Johannesburg, aims to bring together developing and industrialized country governments, public and private organizations, multilateral institutions and consumers to tackle the issue of energy access and poverty reduction. The GVEP initiative focuses on energy supply to foster local employment and social services in the *Franja Transversal del Norte* (FTN), one of the most isolated and excluded eco-regions of the country. In Phase I, the activities focus on identifying how energy services can leverage and complement integrated rural

development programs in the FTN, coordinating with the agricultural, energy, health, education and environmental sectors to set a road-map for a full implementation based on a mix of soft loans and grants. GVEP's focus on integrating social and productive activities will be of great value to the PURE project. Through GVEP, pre-feasibility studies have been conducted for 18 small hydro plants and will be used as an input to the PURE project. Also, PURE will use the GVEP multi-sectorial Working Group as its project steering committee, as will be detailed in chapter 3 (management arrangements).

105. Lessons learned from the above-mentioned projects can be summarized as follows:

- Decentralized energy projects should be based on local energy needs and enhance end-user involvement at the planning and design stage. Local conditions, potential energy uses and social context should determine the choice of technological options. Local participation, including financial participation to, at minimum, cover operational and maintenance costs, is essential to the success of technology promotion;
- Projects need to go beyond technology demonstration towards building an enabling environment at local, national and regional levels, which is essential to increase private sector participation. This also includes infrastructure and capacity building for distribution, installation, maintenance and operation of renewable energy technologies (RETs);
- To facilitate the integrated adoption of improved agricultural practices, productive uses and RE technologies, technical assistance to farmers should be made available through a 'one-stop-shop' approach;
- New funding and financing approaches, linked with productive use, need to be developed to ensure that projects influence the development of sustainable markets for RE technologies. This is essential both to ensure the sustainability of individual projects and to leverage private sector finance capital for new initiatives that replicate project benefits;
- The design of renewable energy projects that promote productive activities need to have a clear understanding of the productive use potential in the beneficiary community, to ensure adequate energy supply and financial viability;
- Increased attention should be paid to social issues and the cultural aspects of the, mostly indigenous, communities during project site selection to ensure that project benefits reach all segments of rural society, alleviate poverty and decrease economic and social disparities;
- Off-grid power projects must be integrated in a broader and well-conceived rural development strategy.
- On-grid renewable energy projects in rural areas must consider the social implications of their intervention on the communities that own and/or use the natural resource.

106. In conclusion, the three smaller UNDP-funded energy-linked projects have provided the political space and experience to support the design of the full-sized PURE initiative, which will build on their experience and, on its turn, will mobilize additional government and public sector counterpart funding.

107. A number of ongoing projects has links with the PURE project:

- The *National Program for Rural Development, Phase I – Western Region (Programa Nacional para Desarrollo Rural, Fase I – Región Occidental)* has strong links with the PURE project. The program is primarily financed by an IFAD loan, channeled through MAGA. Its overall objective is to significantly reduce poverty, prevent social exclusion and discrimination among the poorest segments of the Guatemalan population in the country's western highlands (Huehuetenango, San Marcos, Quetzaltenango, Totonicapán and Sololá, Alta Verapaz and El Quiché) through rural integrated and environmentally sustainable socio-economic development. A detailed description of the program is given in Section F.
- The project *Strengthening National Capacities for Stage II of Adaptation to Climate Change* (primarily financed by GEF and channeled through MARN; total project cost: USD3.2 million) is related with the natural resources management component of PURE.
- The recently approved (March 2006) WB-funded *Project to Support a Rural Development Program* (implemented by SEGEPLAN), focusing on strengthening productive chains and institutional capacity of public entities.

Box 2 - Renewable Energy Based Small Enterprise Development in the Quiche Region of Guatemala

The Productive Uses of Renewable Energy Full Size project builds on the experience of a UNDP/GEF MSP executed during 2000-2002 by Fundación Solar, with a total GEF budget of \$383,000. This initiative was successful in providing energy access to remote rural and indigenous communities and establishing local community organizations (“OLAPES”) that administer the energy services, charge for electricity, and provide O&M services to users. The MSP also conducted activities associated with small business development and productive uses of renewable energy. Since El Quiché is one of the five departments included in the target region for this project, this initiative will be able to scale up the successful aspects of the MSP. The OLAPES will form the basis for the local renewable energy management arrangements for off grid investments. The supply chains will be strengthened to ensure an adequate distribution of RE equipment and spare parts. The productive uses of energy emerging from the MSP have been closely studied, thus providing valuable lessons that have been incorporated to this proposal.

The project has undergone an independent final evaluation, which determined that the results of this initiative were mostly positive. The evaluation highlights Fundación Solar’s technical capacity with RE technology, its capacity to leverage additional financing for the project, and its capacity to establish community organizations that are motivated and willing to contribute to the renewable energy effort. The fact that the OLAPES are still functional to this date and that the RE investments conducted during the MSP is fully operational demonstrates the project’s success in this field. The evaluation also notes that the productive use component of the project could have been stronger, since the development of sustainable small and medium enterprises was not evident at the time of the project conclusion. Two main lessons have been learned from this experience:

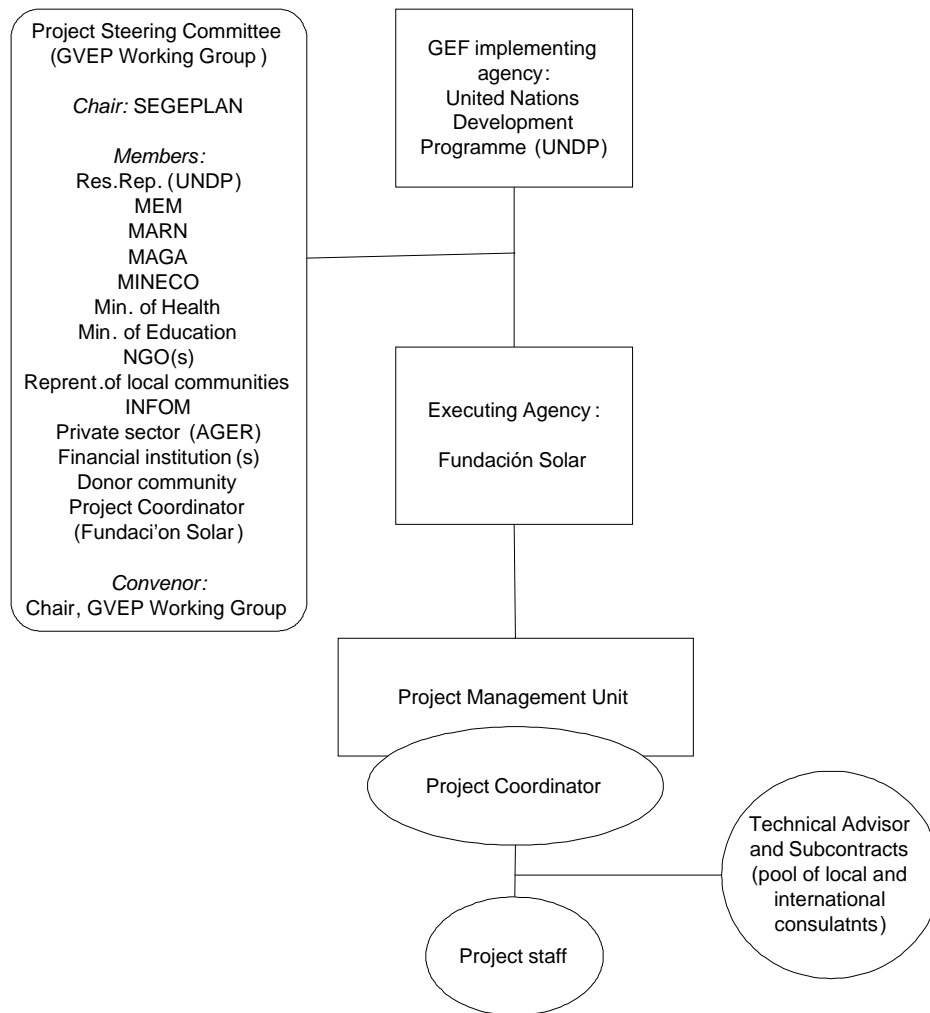
- a) Design of energy generation facilities and productive use assessment must go hand in hand. The MSP focused initially only on generation, and only approached the productive use component in its final year. Therefore, by the time the project was finished, productive uses were not fully developed. Furthermore, in some cases, there was a discrepancy between the energy provided by RE and the productive needs of the community. It is important to note, however, that in the 2002-2004 periods (after the final evaluation) some productive uses have, in fact, developed in the project area.
- b) Development of productive uses is not only an energy issue; it is a rural development issue. Providing access to electricity is only an initial step in a productive uses program. Access to financing, development of productive chains, creating and/or accessing “green markets” for products, and strengthening local capacities to develop small and medium enterprises are all essential components of this process.

These conclusions have been fundamental for the design of this initiative. The Full Size project approach draws from this experience by a) focusing on the assessment and development of value added productive chains where RE is an essential input to the process, and b) ensuring multi stakeholder political and financial support for the project, including three ministries (Environment, Agriculture, and Energy), local communities, and the private sector.

3.2 Project management and coordination

108. The project will be implemented by UNDP and executed by Fundación Solar (NGO execution), which has successfully worked with UNDP Guatemala and the Ministry of Energy and Mines in previous sustainable energy projects. Fundación Solar is a private development organization, formally registered in Guatemala through Ministerial Decree no. 302 in 1994. The main areas of work of Fundación Solar are sustainable energy services, environmental services, integrated water resources management. Since its formation, Fundación Solar has accompanied different rural development processes through the implementation of programs and projects focusing in the development of local capacities, strengthening community-based organizations, identifying institutional alliances to stimulate sustainable management and use of natural resources as a means to poverty reduction and protection of environmental and cultural heritage.
109. In the framework of The Global Village Energy Partnership (GVEP), the government of Guatemala (GoG) formed in 2003 a Working Group, then chaired by the Ministry of Energy and Mines (MEM) and further consisting of the Ministry of Environment and Natural Resources (MARN), Ministry of Food, Livestock and Agriculture (MAGA), Secretary of Economic Planning (SEGEPLAN), Ministry of Economy (MINECO), Ministry of Health and Ministry of Education, and a NGO representative. As of June 2006, the GVEP Chair and Focal Point is SEGEPLAN. PURE will use this existing

Figure 1 Project institutional setup



mechanism of multi-stakeholder coordination's as the *Project Steering Committee* (PSC) providing guidance and supervision on the project implementation. In order to coordinate the PURE Project implementation, the GVEP Working Group will be enhanced incorporating, into its coordination and steering activities, the participation of representatives of the local communities and grass roots associations to ensure that the voice and concerns of the end users is fully incorporated in the project implementation.

110. Also, governmental projects, such as *Guate-Invierte* (investments), *Guate-Verde* (Environmental Program), *Guate-Compite* (Competitive advantage Program), and *Guate-Crece* (Economic Growth Program) as well as the National Institute for the Promotion of Municipal Entities (INFOM) will be incorporated to attract additional resources for project investment. INFOM funnels financial resources from IDB, World Bank and other financial entities. Furthermore, the main social investment funds the National Peace Fund (FONAPAZ) and the Social Investment Fund (FIS), will be integrated, because they have been key co-founders of the medium size project; therefore, they can provide essential counterpart funding²⁹.
111. The private sector, through, AGER will play an important role, both, as co-founders of the PURE Project, as well as RET project developers. Finally, the donor community (USAID, Japan, European

²⁹ This coordination at national level will be reflected at local level for each MHP subproject to be developed as, for example, is demonstrated in the financing mix of the Chel MHP subproject (as described in Section D).

Union, the Netherlands, Canada and China) will be invited to participate *ah doc* to explore synergies with their programs in the same area of work.

112. The PURE Project will use the GVEP Coordination and Steering committee, as indicated in the figure, providing guidance, coordination, founding leverage and supervision for the project implementation. Essentially, at least all participating entities in project, co-financing and implementing, will be invited to participate in the regular monthly meetings, to oversee the smooth running and effective execution of programmatic activities and budgets allocations and to allow for strategic planning, adaptive management and logistical coordination to take place.
113. Since the GVEP working group includes SEGEPLAN (which is the national institution that oversees international cooperation) and other Government entities, such as MAGA, MARN and MEM, this will allow national stakeholders to develop and update coordination with other ongoing national and regional projects executed by these entities, such as:
 - National Program for Rural Development, phase 1 (financed by IFAD though MAGA and administered by UNDP)
 - Strengthening National Capacities for Stage II of Adaptation to Climate Change (administered by UNDP and implemented by MARN)
 - Regional Indigenous Integrated Ecosystem Management (financed by IDB and WB with a GEF contribution)
 - Project to Support the Rural Development Program (SEGEPLAN, financed by BM/BID/Sweden)
114. The coordination throughout the GVEP working group, will focus on two main activities: i) identification of synergies between GOG, local communities, private sector, municipal Government and donor community to funnel funding for project implementation based on value added production chains that use RET and requires integrated watershed management to have advantage of natural renewable resources; ii) coordination with other projects, funded by UNDP, World Bank and IDB or other donors (but executed by the before-mentioned key government ministries) that will have activities related to watershed management, agro-forestry and micro-enterprise development.
115. The *Project Coordinator* will be responsible for formulating and submission of work and financial plans top the Project Steering (GVEP) Committee, that will be monitoring a work progress, coordination with the various government ministries and agencies, ensuring the timely provision of government inputs providing guidance to the project team of national and international consultants, coordination with UNDP, reviewing reports and to look after administrative arrangements required under UNDP procedures. Together with full or part-time project staff³⁰, the Project Coordinator forms the *Project Management Unit* that will be externally supported by a part-time GEF *Technical Advisor*, contracted by UNDP, and *subcontracted parties* to carry out the specific project activities mentioned in Section A. Terms of References of the Project Coordinator and PMU are given in Section E.
116. Fundación Solar will be held accountable by the UNDP Guatemala and the Project Steering Committee for the use US\$ 2.65 million provided by the GEF. Resources will be transferred to Fundación Solar's Financing and Accounting Department through direct payments. In turn, Fundación Solar will disburse funds through sub-contracts and grants and closely monitor their use by soliciting financial and technical reports. The co-financing of USD 11 million will be managed individually by each of the partner organizations and each will develop its own accountability mechanisms and criteria.

³⁰ Additional PMU project staff (full -time and part-time) may include national consultants: (i) a rural energy infrastructure advisor, (ii) a financial -administrative advisor, (iii) a rural economy, micro -financing and rural credit specialist, (iv) a micro-enterprise and organization specialist, (v) a gender and energy specialist, (vi) a solar energy specialist, (vii) a hydroelectricity specialist, and (viii) bi -lingual Spanish-local languages social workers.

4. MONITORING AND EVALUATION PLAN

117. Project monitoring and evaluation (M&E) will be conducted in accordance with established GEF procedures as well as following new UNDP procedures in the ATLAS system. Project M&E provided by the project team, supported by UNDP, i.e., the UNDP Country Office (CO), the UNDP-GEF Regional Coordinating Unit (RCU) and the UNDP Sub-Regional Resource Facility (SURF). The attached Logical Framework Matrix in Section B provides *performance* and *impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built throughout the 5-year implementation period (2006-2010).
118. The principle components of the Monitoring and Evaluation Plan will include: (1) a project inception phase, (2) establishing monitoring responsibilities and events, (3) project reporting and (4) independent evaluations. The project's Monitoring and Evaluation Plan will be presented and finalized at the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities.

Project inception phase

119. A Project Inception Workshop will be conducted with the full project team, relevant government counterparts (as mentioned in paragraph 3.2), co-financing partners and UNDP representatives. The fundamental objective of this Inception Workshop will be to assist the project team to understand and take ownership of the project's goals and objectives, to finalize coordination arrangements with existing initiatives as well as to finalize the preparation of the project's first Annual Work Plan (AWP) on the basis of the project's log frame matrix (as given in Section B). This will include reviewing the log frame (indicators, means of verification, assumptions), imparting additional detail as needed, and on the basis of this exercise, finalizing the AWP with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project. Targets and indicators for subsequent years would be defined annually as part of the internal evaluation and planning processes undertaken by the project team.
120. Additionally, the purpose and objective of the Inception Workshop (IW) will be to: (i) introduce project staff with the UNDP CO and GEF Regional Coordinating Unit (RCU) staff; (ii) detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team; (iii) provide a detailed overview of UNDP-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the combined Annual Project Report (APR -PIR) as well as mid-term and final evaluations. Equally, the Inception Workshop will provide an opportunity to inform the project team on UNDP project related budgetary planning, budget reviews, and mandatory budget rephasings and (iv) discuss the Terms of Reference for project staff and decision-making structures (Project Management Unit, Steering and Advisory Committees) will be discussed again, as needed, in order to clarify for all each party's responsibilities during the project's implementation phase.
121. Due to the complexity of monitoring such an integrated initiative, a specific task force will carry out research on existing data in particular for vegetation cover of project area and economic and social data available. These two aspects are key in monitoring the project development and adapting project activities as necessary. Complementary to this, a specific monitoring activity will aim at estimating the carbon sequestration benefit of the present initiative.

Monitoring responsibilities and events

122. A detailed schedule of project reviews meetings will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for Steering and Advisory Committee Meetings and (ii) project related Monitoring and Evaluation (M&E) activities.
123. *Day-to-day monitoring* of implementation progress will be the responsibility of the Project Coordinator, based on the project's Annual Work plan and its indicators. The Project Team will inform

the UNDP CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

124. The Project Coordinator and GEF Technical Advisor will fine-tune the progress and performance/impact indicators of the project in consultation with the full project team at the Inception Workshop, as discussed above. Measurement of impact indicators related to global benefits will occur according to the schedules defined in the Inception Workshop, but at least three times, at the beginning (baseline study), mid-term and end of the project. The measurement, of these will be undertaken through subcontracts or consultants with relevant institutions (e.g. vegetation cover via analysis of satellite imagery, or populations of key species through inventories) or through specific studies that are to form part of the projects activities (e.g. measurement carbon benefits from improved efficiency of ovens or through surveys for capacity building efforts) or periodic sampling such as with sedimentation.
125. *Periodic monitoring* of implementation progress will be undertaken by the Project Steering Committee through monthly meetings and UNDP CO through quarterly meetings with Fundación Solar or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.
126. UNDP Country Office and UNDP-GEF RCU staff can conduct, as appropriate, visits to the project and project that have field sites to assess first hand project progress. Any other member of the Project Steering Committee can also accompany, as decided by the Committee. A Field Visit Report will be prepared by the CO and circulated no less than one month after the visit to the project team, all PSC members and UNDP-GEF.
127. *Annual Monitoring* will occur through the Annual Project Report (APR). The APR -PIR will highlight policy issues and recommendations for the decision of the PSC participants. The Project Coordinator also informs the project participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project component may also be conducted if necessary.

Project reporting; learning and knowledge sharing

128. The Project Coordinator will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a) through (f) are mandatory and strictly related to monitoring, while item (g) has a broader function and the frequency and nature is project specific to be defined throughout implementation.

a) Inception Report (IR). A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/Annual Work Plan (AWP) divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This AWP would also include the dates of specific field visits and support missions from UNDP CO or RCU staff or Technical Advisors. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame. The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related (co-financing) partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may effect project implementation. When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the Inception Report, the UNDP Country Office and UNDP-GEF's Regional Coordinating Unit will review the document.

Table 5 Indicative M&E workplan and budget

| Type of M&E activity | Responsible Parties | Budget US\$ | Time frame |
|---|---|---|---|
| Inception Workshop | § Project Coordinator § UNDP CO § UNDP GEF | 5,000 | Within first two months of project start up |
| Inception Report | § Project Team § UNDP CO | 0 | Immediately following IW |
| Measurement of Means of Verification for Project Purpose Indicators – Baseline & impact studies | § Project Coordinator, advised by International Technical Advisor | 20,000 | Start, mid and end of project. To be finalized in Inception Phase and Workshop. |
| Measurement of Means of Verification for Project Progress and Performance (project outputs and deliverables, measured annually) | § Oversight by International Technical Advisor and Project Coordinator § Measurements by regional field officers and local IAs | To be determined as part of the Annual Work Plans. Indicative cost 10,000 | Annually prior to APR/PIR and to the definition of annual work plans |
| APR and PIR | § Project Team § UNDP-CO § UNDP-GEF | 0 | Annually |
| Steering Committee Meetings | § Project Coordinator § UNDP CO | 0 | Following Project IW and subsequently at least once a year |
| Periodic status reports | § Project team | 5,000 | To be determined by Project team and UNDP CO |
| Technical reports | § Project team § Hired consultants as needed | 15,000 | To be determined by Project Team and UNDP-CO |
| Mid-term External Evaluation | § Project team § UNDP- CO § UNDP-GEF Regional Coordinating Unit (RCU) § External Consultants (evaluation team) | 20,000 | At the mid-point of project implementation. |
| Final External Evaluation | § Project team § UNDP-CO § UNDP-GEF Regional Coordinating Unit § External Consultants (i.e. evaluation team) | 30,000 | At the end of project implementation |
| Terminal Report | § Project team § UNDP-CO § External Consultant | 0 | At least one month before the end of the project |
| Lessons learned | § Project team § UNDP-GEF Regional Coordinating Unit (suggested formats for documenting best practices, etc) | 5,000 | Yearly |
| Audit | § UNDP-CO § Project team | 5,000 | Yearly |
| Visits to field sites (UNDP staff travel costs to be charged to IA fees) | § UNDP Country Office § UNDP-GEF Regional Coordinating Unit (as appropriate) § Government representatives | 30,000 | Yearly |
| TOTAL INDICATIVE COST | | | |
| Excluding project team staff time and UNDP staff and travel expenses. | | US\$ 145,000 | |

*b) Annual Project Report (APR-PIR)*³¹. The APR was a UNDP requirement; while the PIR was an annual monitoring processes mandated by the GEF and are now combined to facilitate central oversight, monitoring and project management. It is a self-assessment report by project management to the CO, providing inputs to the CO reporting process, as well as forming a key input to the UNDP/GEF M&E Unit, which analyzes the APR-PIRs by focal area, theme and region for common issues/results and lessons.

c) Quarterly Progress. Short reports outlining main updates in project progress will be provided quarterly to the local UNDP Country Office (and forwarded to the UNDP-GEF RCU) by the Project Coordinator.

d) Periodic Thematic Reports. As and when called for by UNDP-GEF or PSC, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNDP and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. UNDP will allow reasonable timeframes for their preparation by the project team.

e) Project Terminal Report. During the last three months of the project the project team will prepare the Project Terminal Report. This comprehensive report will summarize all activities, achievements and outputs, objectives met (or not achieved!) of the Project, as well as lessons learnt and structures and systems implemented. It will also lay out recommendations for any further steps that need to be taken to ensure sustainability and replicability of the Project's activities.

f) Technical Reports. Technical Reports are detailed documents covering specific areas of analysis or scientific specializations within the overall project. As part of the Inception Report, the project team will prepare a draft Reports List, detailing the technical reports that are expected to be prepared on key areas of activity during the course of the Project, and tentative due dates. Where necessary this Reports List will be revised and updated, and included in subsequent APR -PIRs. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of research within the framework of the project and its sites. These technical reports will represent, as appropriate, the project's substantive contribution to specific areas, and will be used in efforts to disseminate relevant information and best practices at local, national and international levels.

g) Project Publications. Project Publications will form a key method of crystallizing and disseminating the results and achievements of the Project³². These publications are informational texts on the activities and achievements of the Project, in the form of journal articles, multimedia publications, etc. These publications can be based on Technical Reports or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if any of the Project or Technical Reports merit formal publication, and will also (in consultation with UNDP, the government and other relevant stakeholder groups) plan and produce these Publications in a consistent and recognizable format. Project resources will need to be defined and allocated for these activities as appropriate and in a manner commensurate with the project's budget.

129. Results from the project will be disseminated through a number of existing information sharing networks and forums. The project will participate, as relevant and appropriate, in UNDP and GEF sponsored knowledge networks, organized for staff working on activities that share common characteristics. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identify and analyzing lessons learned is an

³¹ The APR (Annual Project Report) was a UNDP requirement, while the PIR (Project Implementation Review) was an annual monitoring process mandated by the GEF, and that are now combined to facilitate central oversight, monitoring and project management.

³² The document 'Productive Uses of Renewable Energy (PURE) in Guatemala', elaborated in the PDF B startup phase is attached as Section D.

on-going process and communicating such lessons is a requirement to be delivered not less frequently than once every 12 months. UNDP/GEF shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

Independent evaluation

130. The project will be subjected to at least two independent external evaluations as follows:

Mid-term Evaluation

131. An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation, will highlight issues requiring decisions and actions and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO, based on guidance from the UNDP-GEF RCU.

Final Evaluation

132. An independent Final Evaluation will take place three months prior to the project's termination date and will focus on the same issues as the mid-term evaluation and, in addition, will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO, based on guidance from the UNDP-GEF RCU.

Audit Clause

133. Fundación Solar will provide the UNDP Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted by the legally recognized auditor of the Government, or by a commercial auditor engaged by the Government.

5. LEGAL CONTEXT AND OTHER AGREEMENTS

134. The administration of this project shall be governed by UNDP rules and procedures as defined in the Programming Manual within the policy context defined by the Executive Board. The present Project Document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement (SBAA) between the Government of Guatemala and the United Nations Development Program, signed by the parties on 20th July 1998 and ratified by Degree 17-2000 on 29th March 2000.
135. Any additional agreements, such as cost sharing agreements, project cooperation agreements signed with NGOs (where the NGO is designated as the "implementing partner" the "*standard project cooperation agreement between UNDP and NGO*" is included in Section J). The GEF project document will include the approved Project Proposal (full-sized project Executive Summary) and mandatory and optional annexes.

SECTION B. STRATEGIC RESULTS FRAMEWORK

1. INCREMENTAL COST ANALYSIS

1.1 Project background

136. The development objective is exploitation of indigenously available renewable energy resources integrated with environmentally sustainable development and poverty reduction in rural areas. Under the GEF-supported alternative scenario, the value added resulting from a 'productive use of energy (PUE)' program will contribute to sustainable development in rural areas, seeking to bring employment and other economic as well as social benefits to the rural population.
137. The project will seek increased local benefits through two separate energy-related approaches:
- Shared benefits of locally produced and nationally sold (grid connected) renewable energy. First estimates indicate an internal rate of return close to 12% of implemented grid-connected mini hydro projects;
 - Extension of the local production chain of processed export products/commodities, including organic coffee, cardamom and timber products, which are processed locally through drying, dehydrating, sawing and packing, using renewable energy as process input, with consequential added value to the local economy. The sustainable use of locally available water and energy resources for processing creates value added to local products and has the potential to provide communities with better sources of income and higher living standards.

1.2 Incremental cost assessment

Baseline

138. In the baseline scenario, the renewable energy potential in rural Guatemala will continue to be underdeveloped, with substantial implications for local communities, the national government, and the global environment. Grid extension will continue to be the standard electrification approach of the government, at a large taxpayer cost and low coverage at the rural level. Development in off-grid and renewable energy in rural areas will remain very limited. Therefore, in the baseline scenario, the energy situation in rural Guatemala will continue to be characterized by:
- Local communities will have no access to financial resources to develop their locally available renewable energy (RE) sources, in particular the hydropower resource. Potential added-value activities stemming from access to energy will not be examined or fully understood, thus limiting the return on investment in renewable energy. In this way, the inadequate access to affordable modern energy supply will continue to constrain productivity and hinder the improvement of living conditions.
 - Families will remain dependent on the use of inefficient technology (such as candles and batteries for lighting) as energy sources in rural communities or adopt fossil fuel based technologies (such as diesel generators).
 - Few government resources will be directed to RE investment, and the majority of available resources will be dedicated to grid extension. Private investment in renewable energy will not occur because (a) isolated RE systems are not perceived as an attractive investment, and (b) the regulatory and institutional arrangements allowing grid connected RE to be distributed are not in place.
 - The focus on grid coverage extension and diesel generators for off-grid electrification will delay investment in other forms of energy production (thus contributing to increased greenhouse gas emissions from the energy sector).

GEF alternative

139. The global environment objective is to reduce greenhouse gas emissions generated by thermal power generation in the national grid system and by diesel-based generators and village min-grids in isolated areas. The strategic goal of the PURE initiative is to install and operate up to 13.5 MW of grid-connected RET (small hydropower) and 1.5 MW of off-grid RET applications (mini/micro hydropower, solar thermal and solar PV) thus directly reducing 1.7 million tons of CO₂ over a 20-year period.
140. The fundamental concept is to promote renewable energy in communities (that are mostly consisting of indigenous Maya people) where the value of local goods will be enhanced through productive uses. The project will link local producers with national and global markets. This will secure additional income, thus alleviating poverty in these areas and providing financial resources to ensure the sustainability of the renewable energy initiatives. This is an innovative approach compared to the more traditional one where the main focus was on meeting basic energy needs. Energy becomes a fundamental input of an operational framework that catalyzes an added-value productive chain.
141. Existing barriers for the dissemination of productive uses (PUE) of energy generated by renewable energy technologies (RET), in particular mini/micro hydropower will be addressed by fostering a multi-stakeholder dialogue that steers inter-institutional cooperation to respond to demand-driven community needs for PUE. The executing agency will catalyze and coordinate agreements to materialize commitments to income generation activities that mitigate GHG emissions through renewable energy technologies. Also, the project will provide a set of tools for decision making, planning, implementation, and monitoring, to promote the sustainability of innovative options for natural resources management through targeted capacity building and stakeholder strengthening.
142. The project's strategy therefore integrates various dimensions: (i) *mitigation* of GHG emissions through promotion of renewable energy technologies (RET) that are linked to (ii) *income generation and productivity enhancement* through productive uses of energy, being made sustainable through the incorporation of (iii) *adaptation to climate change* considerations that consider vulnerability and natural resource management practices that are relevant to sustainable livelihoods at the community level, and (iv) by providing the necessary *support to relevant policy making* and regulations and to a national and local multi-stakeholder dialogue and long-term collaboration, that are required for successful replication of the project in the national context.
143. The alternative scenario to be achieved through the implementation of this project is characterized by:
 - Increased use of and knowledge about RE for productive uses in rural areas with a sufficient level of technical services and financial support to warrant a sustainable operation;
 - Well-functioning markets that generate increased local income for productive uses of RE, including adequate market information and access as well as accessible financing mechanisms both for RE users, vendors and other market actors;
 - An enabling environment for RE for isolated and grid connected generation projects, with mechanisms that guarantee the evolution of policies to respond to new developments.

System boundary

144. The geographical boundary of the proposed full-sized project is the national territory of Guatemala. Project activities will focus on the "poverty belt" in the western highlands of Guatemala (departments of Alta Verapaz, Baja Verapaz, Quiché, Huehuetenango, and San Marcos), where an anticipated 13.5 MW of small hydropower capacity will be installed over the period 2006-2010 as well as about 1.5 MW of off-grid RET applications for productive uses.
145. As designed, scope of the project has two main components. On one hand, productive uses of renewable energy are proposed as a mechanism to ensure the feasibility and sustainability of both grid-connected and off-grid RE investments. Therefore, the objective of the productive use component is to generate sufficient local levels of income to cover, at least, the O&M costs of off-grid RE investments, and to create local benefits for communities to support private investment in RE (in particular, for the grid-connected investments).

146. On the other hand, the watershed management component of the project also targets system sustainability. All activities conducted under this component aim to generate a sustainable use of watersheds that values the use of water as an energy resource. This effort focuses on two components; a) reducing the vulnerability of the actual hydroelectric facilities to climate variation through adequate design, and b) ensuring that social and institutional arrangements are in place for sustainable watershed management in the, mainly indigenous, rural communities.

Additional benefits

147. Small-scale RET projects contribute to increased foreign investment, mobilize commercial bank participation in the renewable energy arena, reduce dependence on imported fossil fuels (oil); improve the country's energy balance/mix and contribute to economic development activities in often remote areas and lastly they generate employment benefits at the local level (productive uses of energy) and the national level (local assembly and partial manufacturing of hydropower equipment).

Costs

148. The total cost of the proposed initiative is US\$ 14,050,000. The total *incremental cost* of the GEF alternative is US\$ 2.55 million (excluding the US\$ 100,000 GEF PDF B support). The *co-financing* consists of cash contributions of US\$ 11 million, coming from the Ministry of Agriculture, Livestock and Food (MAGA), municipalities and the renewable energy association AGER, as well as of in-kind contributions valued at US\$ 500,000, coming from the Government and Fundacion Solar.
149. In addition, investment in the hardware of the mini and micro hydropower stations implies a *parallel financing* by private sector and other sources, thus leveraged by PURE, at an estimated US\$ 55,950,000³³.

Global benefits

150. The installation of 15 MW of renewable energy (13.5 MW of grid-connected mini hydropower and 1.5 MW of off-grid RET applications (basically mini/micro hydropower), supplemented with solar energy where applicable) will result in a reduction of approximately 1.75 million tons of CO₂-equivalent over the lifetime of the RET installations (20 years) as a direct impact of the proposed PURE initiative (see paragraph 1.3 of this section for a more detailed estimate). A conservative estimate of the indirect impact of this project, from expanded RET on-grid and off-grid developments that are triggered by the proposed barrier removal activities, results in at least 5.25 million tons of CO₂ reduction.

³³ Assuming that 1.5 MW of off-grid micro hydropower is established at an investment cost of US\$ 5,800 per kW and that 13.5 MW of on-grid hydropower is established at an investment cost of US\$ 3,500 per kW.

Table 6 Incremental cost matrix

| | BASELINE | ALTERNATIVE | GEF INCREMENT |
|--|--|--|--|
| OUTCOME 1 | | | |
| Development of 1.5 MW Off-Grid RETs (micro hydro) for Productive Uses | | | |
| 1.1 Integration of 'high-value' products into commercial chain | Commercial chains in rural Guatemala continue to develop excluding isolated rural, mostly Mayan, communities. | Integration of 'value added' products is achieved, enabled by PUE (based on RETs), thus demonstrating the benefits to local development. The demonstration of the energy/productivity link catalyzes project sustainability and replication. | Access to energy alone does not improve production or productivity, but goes hand-in-hand with business improvement and marketing of new products |
| 1.2 Development of 1.5 MW of off-grid micro hydro (and solar energy) | Communities with an endowment of natural and agricultural resources for productive use development are likely to pursue mainly installation of diesel isolated generator sets for energy provision. The GoG will divert funds to this end. | The use of targeted support provides access to energy based on RET and PUE development will contribute to reducing GHG emissions and increasing development opportunities at the local level. | Increased offer of RET (mainly mini/micro hydropower) based energy services, and auxiliary services for project implementation in rural context. |
| 1.3 Increased capital mobilization for PUE lending | Rural off grid areas continue to be seen as risky on the perception of local financial institutions; therefore no development of instruments takes place due to lack of finance for RET-based PUE | Start of capital flows in rural off-grid areas of Guatemala will create momentum for lending for PUE enabled by rural off-grid development | Capacity mobilized as seed lending capital in rural Guatemala for RET and PUE |
| 1.4 Local capacity building and small business development | Capacity to set up and manage (energy) enterprises continues to be non-existent, especially in the indigenous communities | The concept of RET and PUE cross-fertilization demonstrates the feasibility of this development path for rural, indigenous and non-indigenous communities. | Capacity established in key areas of micro-enterprise development (PUE) as well as technical and managerial aspects of RET-based energy and activities |
| 1.5 Review of technology support system for hydro and other RETs | Diesel gensets continue to provide low quality service with high O&M cost. Support systems for RET continue to be fragmented and provide inadequate service. | Integrated support systems for RET address end user needs. | Identification of support gaps and targeted capacity building programs |
| <i>COST</i> | <i>US\$ 6,036,604</i> | <i>Total: \$: 7,015,909 (Parallel funding: US\$ 8.7 million)</i> | <i>GEF: US\$ 979,305</i> |

| | BASELINE | ALTERNATIVE | GEF INCREMENT |
|---|---|---|--|
| OUTCOME 2 | | | |
| Development of 13.5 MW of Grid-connected RET (mini hydro) | | | |
| 2.1 Development of grid-connected mini hydro | Extension in the grid is likely to be based on fossil-fuelled thermal power. The enormous RE (small hydro) potential in Guatemala will not benefit the country, local (Mayan) communities or contribute to mitigation of GHG emissions | Use of commercially viable small hydropower production by private developers will contribute to reducing greenhouse gas emissions | Auxiliary services and assessment for development of small hydropower in the project area |
| 2.2 Productive uses of RE catalyze rural development in communities | Private investment in energy fails to consider local development needs. Rural communities remain in poverty and have a negative image of private investment. Small hydro projects, although financially viable, do not materialize. | Benefit sharing arrangements allow an increase in investment in on-grid small hydropower development. Local, mainly Mayan, communities, obtain direct benefits from private investment. | Establishment of appropriate mechanisms for benefit sharing. Capacity development for extension of value added productive chains. |
| 2.3 Stakeholder engagement and environmental good practices in small-scale hydro development | Conflicts between community stakeholders and project developers of small hydro power in Guatemala will continue to escalate, due to perceived institutional ineffectiveness of conflict resolution, thus continuing the delay in grid-connected RET development | Dialogue improves, and resolution strategies linked to implementing local development benefits, benefit both levels of stakeholders (Mayan and other rural communities benefiting at the local level, and developers available to reduce lead times for integration and dispatch in the grid) | Local capacity created for environmental awareness creation and conflict resolution between developers of small hydro and community stakeholders |
| <i>COST</i> | <i>US\$ 3,915,804</i> | <i>Total: \$ 4,563,219 (Parallel funding: US\$ 47.25 million)</i> | <i>GEF: US\$ 647,415</i> |
| OUTCOME 3 | | | |
| Sustainable Natural and Energy Resources Management in River Basins | | | |
| 3.1 Local enabling environments for participatory watershed management integrated with natural resources management for RE generation and vulnerability aspects | Baseline continues to see natural resources management, energy development and vulnerability mitigation as isolated activities in local rural development and that are conducted in a top-down approach, without the involvement of stakeholders | Local communities and municipalities engage in a common goal to develop integral river basin management plans to develop the natural and energy resources sustainable and to respond to vulnerability and emergencies | Empowerment of indigenous people and local participation in river basin committees will increase success of energy and rural development in the project sites. |
| 3.2 Better management practices in | Capacity to implement better management practices will | Communities become engaged in better | Subproject areas operating in the PURE |

| | BASELINE | ALTERNATIVE | GEF INCREMENT |
|--|---|---|--|
| agriculture, forestry and animal husbandry | continue to depend on ad-hoc extra-community interventions | management practices in a consistent approach with natural and energy resource management and income-generating activities | project implement better practices in agriculture and forestry, enabling RET-based PUE in these areas and become examples to other communities in Guatemala. |
| <i>COST</i> | <i>US\$ 1,082,592</i> | <i>Total: \$ 1,337,092</i> | <i>GEF:US \$ 254,500</i> |
| OUTCOME 4 | | | |
| Conditions for project replication are established (including policy and regulatory proposals); monitoring, learning and evaluation | | | |
| 4.1 Monitoring, learning, feedback and evaluation | There is no available project monitoring tool linking global benefits of mitigation and adaptation with the local benefits of reduced poverty through improved income and sustainable livelihood. Common practice of small-scale hydro power development, disconnected with natural resources management and income generation, will continue | A tool is available and disseminated through appropriate mechanisms, detailing methodological issues. Stakeholders are sensitized and aware of existing linkages and responses. Capacity building is in place for replication of this project into a wider national program | Increased use of methodological tools linking mitigation and adaptation issues with poverty reduction objectives of RET (especially small and mini/micro hydropower) projects in rural off-grid communities. Lessons learned from the implementation of proposed activities are disseminated |
| 4.2 Enabling environment proposed of regulatory instruments for independent small-scale hydropower producers | Continuation of lack of regulatory mechanisms for independent RET-based production for the national grid limits the development and market dispatch of RET, contributing <i>de facto</i> to increase of GHG emissions in the operation and capacity addition of the Guatemala electricity grid. | Small scale RET based on grid connected projects find market mechanisms to be dispatched, assisting Guatemala to continue a path of de-carbonization of the energy sector and assisting sustainable development. | Guatemala to implement adequate mechanisms to improve market conditions in support of RET under reformed market conditions. |
| 4.3 Proposed policy directives on off-grid rural energy provision with small-scale hydropower and solar energy | Government continues without a rural off grid policy framework, excluding rural populations, especially the Mayan language speakers, from the local benefits of improved energy access, thus limiting development opportunities and limiting its commitments to reach the millennium development goals | Policy directive in place, linking global objectives and local development needs by supporting access to modern energy services with a balanced consideration to RET and PUE | Policy directive mobilizes the commitment of Government to secure the necessary monetary installments required for maintaining a interagency program linking rural off grid energy provision using RET and PUE. |
| 4.4 Improved policy dialogue on the | Government agencies and ministries continue to deal with | Government agencies improve in discussion | Increased number of Government |

| | BASELINE | ALTERNATIVE | GEF INCREMENT |
|---|--|---|---|
| linkages between energy supply, rural development, natural resources management and climate-change adaptation | development issues and links to global issues in a non-integrated fashion, maintaining implementation inefficiencies in program development, especially in issue relating the contribution to global benefits and local sustainable development paths. | and design and implementation of relevant programs related to sustainable development in the country. Improved participation and policy dialogues will assist Guatemala and its society to enhance discussion of climate change issues. | stakeholders and programs improve coordination and implementation by considering both mitigation and adaptation issues in the context of local sustainable development benefits |
| <i>COST</i> | <i>\$ 140,000</i> | <i>Total: \$ 658,780</i> | <i>GEF:US\$ 518,780</i> |
| Total project | Without the project, the energy sector development will continue to be based on fossil fuel. Marginalized, mainly indigenous, communities will lack access to modern energy sources hampering local economic development and the development of the country as a whole. | Directly resulting from the PURE project a path for local sustainable development will emerge. Some 1.75 million tons of CO2 will be avoided as direct impact of the project over 20 years; 5.25 million tons of CO2 will result from project replication. | With a clear mandate to promote initiative including positive global impact, GEF is supporting a valuable effort to integrate global, national, climate change and land degradation aspects. |
| Total cost | US\$11,500,000 (including project management costs) | Total: \$ 14,050,000 (plus US\$ 55.95 million leveraged financing) | GEF: 2,550,000 (including project management costs) |

2. BASELINE AND EMISSION CALCULATIONS

151. The calculation is based on the amount of carbon displaced directly by the direct investment in renewable energy technology (RET) during the implementation of the PURE project. Although the actual portfolio of RET subprojects will be determined in the activities of outputs 1.2 and 2.1, the CO₂ reduction calculation is based on a portfolio of RET subprojects, identified by Fundación Solar, including 13.5 MW of grid-connected mini hydropower and about 1.5 MW of off-grid micro hydropower.

Table 7 Direct emission reduction estimates

| Off-grid | Capacity (kW) | Annual emission reduction (tCO ₂) | On-grid | Capacity (kW) | Annual emission reduction (tCO ₂) |
|--------------------------------------|----------------------------|---|-----------------------------------|----------------------------|---|
| Las Conchas | 190 | 1,018 | Chaxa | 1,852 | 10,902 |
| Seasir | 90 | 576 | Santa Avalina | 1,113 | 6,552 |
| Jolom Ijix | 60 | 334 | Tacaná | 1,800 | 10,596 |
| Chel | 165 | 1,358 | Chel II | 1,400 | 8,241 |
| Sasjsiban | 710 | 3,854 | Chajul | 700 | 4,121 |
| La Vega | 60 | 326 | Ixtupul II | 600 | 3,532 |
| Batz' Chicolá | 30 | 163 | Cotzal I | 865 | 5,092 |
| Lirio Putul | 10 | 54 | Ximula I | 750 | 4,415 |
| Unión 31 de mayo | 55 | 299 | Ximula II | 500 | 2,943 |
| Balanyá-Pixcayá | 55 | 299 | Tzicuay | 300 | 1,766 |
| Guaxabaja | 55 | 299 | Chipal | 350 | 2,060 |
| | | | Cotzal II | 1,200 | 7,064 |
| | | | La Castalia | 2,000 | 11,773 |
| TOTAL | 1480 | 8,578 | TOTAL | 13,430 | 79,059 |
| Assumptions: | | | | | |
| <i>Replacing a diesel generator:</i> | | | <i>Replacing grid electricity</i> | | |
| Emission reduction | 2.07 tCO ₂ /MWh | | Emission reduction | 0.84 tCO ₂ /MWh | |
| Capacity factor | 30% | | Capacity factor | 80% | |

152. The following assumptions are used:

- The off-grid micro hydropower MHP (for consumptive and productive uses) would otherwise have been provided by diesel-based mini-grids a carbon intensity of 2.07 tCO₂/MWh and assuming a capacity utilization factor of 30% (except for Conchas, Seasir, Jolom Ijix and Chel, for which load factors of 30%, 35%, 31% and 45% are used, as were calculated in the case study document of Section D).
- The mini hydropower replaces grid-connected electricity with an emission factor of the national grid 0.84 tCO₂/MWh and a plant utilization factor of 80%.

153. Given the availability of renewable resources in Guatemala, the replication potential for this initiative is theoretically quite large. A conservative assumption is that within 10 years after the project's end, more communities and investors will copy the experiences and venture into similar opportunities installing another 45 MW (replication factor of 3). Over the 20-year lifetime of the MHP stations, this implies **direct emission reduction** of 1.75 million tCO₂ and **indirect emission reduction** of 5.25 million tCO₂.

3. LOGICAL FRAMEWORK ANALYSIS

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|---|--|--|--|--|---|
| <p>PROJECT GOAL (global environmental objective) To reduce Guatemala's greenhouse gas emissions by promoting productive uses of renewable energy with strong rural development benefits</p> | <ul style="list-style-type: none"> § The country will be unable to take advantage of its RE potential. § 7 million tons of CO2 direct and indirect emission reduction over the next 20-30 years. | <ul style="list-style-type: none"> § 1.5 MW of isolated systems is installed. At least 7 off-grid projects are providing energy for PU. § PPAs and benefit sharing agreement in place for 5MW of on grid investment. 1MW of on grid RE in operation. § At least two 'value added' productive chains using Renewable Energy are fully developed and local products access national/international markets | <ul style="list-style-type: none"> § Identified barriers to renewable energy for productive uses are removed § Implementation cost for RET are reduced by 15% overall. Transaction costs for grid connected RET are reduced to a third of the current value. § At least 1.75 million tons of carbon will be avoided by the development of at least 15 MW of RE generation, basically small-scale and mini/micro hydropower linked with productive applications § With the project replication strategy implemented at 5.25 million tons of CO2 will be avoided | <ul style="list-style-type: none"> § Project monitoring and evaluation reports § Project publications § Press releases § Official government documents § Updated Guatemala National Communication | <ul style="list-style-type: none"> § Political stability. § Stable energy markets. |
| <p>OBJECTIVE (development objective) Development of indigenously available renewable energy</p> | <ul style="list-style-type: none"> § The GoG continues to provide financial and TA support to marginalized communities on an ad hoc basis without integration. § The poverty belt, mainly | <ul style="list-style-type: none"> § Local development and cost and benefit sharing agreement adapted to each case is emerging. § Decision makers in the GoG are increasingly showing interest in | <ul style="list-style-type: none"> § Integrating modern reliable RE as part of the local sustainable economic development is recognized as a key factor for success. § Increased local value added | <ul style="list-style-type: none"> § Energy balance § Local business balance sheet and financial reports. § Human development report. | <ul style="list-style-type: none"> § Social and political stability. § Absence of conflicts in project area. § No mayor climate or environmental |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|---|---|---|---|--|---|
| resources of about 15 MW integrated with environmentally sustainable development and poverty reduction in rural areas | inhabited by Mayan language speakers, will remain under attention but no integrated approach including access to modern form of energy to support local economic development will reach isolated communities. | the integrated option and new funds are dedicated to the project. | allows 50% of the concerned population to get out of poverty. § The local diversity and vegetation cover is at least conserved. Improvement is seen in 25% of the concerned communities. § Communities become an example in conservation agriculture and entrepreneurship. | | catastrophes (e.g. earthquake, hurricane) |
| OUTCOME 1 Development of 1.5 MW Off-Grid RETs (micro hydropower) for Productive Uses | § Only a few of the pre feasibility studies by GVEP and MSP portfolio will result in projects. § Communities, especially Mayan, stay poor. Monetary earning less than USD 1 per head | § Conditions in place to develop 0.75 MW of isolated systems. The first off grid project is providing energy for PU. § PUE identified and increased Value Added estimated. § Commercialization channels identified and negotiations in progress. § First isolated plant in operation. § First micro credit granted and PU starting. | § At least 1.5 MW of off-grid RET will be operational by year 4 in communities (of which at least 75% Mayan indigenous people) § At least 5,000 people have direct access to energy services from RETs § At least 40-100 businesses profit from RET energy services for PUE; local value added reaches 20 USD per person annually. § 30% of local families are out of extreme poverty § Upfront subsidy required for off grid RE electrification decreases by 25% | § Project and official documentation (feasibility studies, business plans, MoUs, contracts) § Opening of bank accounts for each off-grid facility to allow for project development and fee collection. § Local entrepreneur considered credit-worthy and individual credit contracts with (micro)-finance institutions | § Political stability allows for investment in rural (indigenous) areas § There is strong municipal support the RET projects as well as strong involvement of the community as a sense of ownership and income generation opportunity § National economic conditions and regional integration (CAFTA) support rural development and 'value added' products for regional and foreign |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|--|---|---|--|--|--|
| | | | § About USD 8 million is committed for investment from private and public sources. | | markets |
| 1.1 Integration of 'high-value' products into commercial chain | <ul style="list-style-type: none"> § Unsustainable use of valuable local wood resources. § Communities stay poor. Monetary earning less than 1 USD per head. | <ul style="list-style-type: none"> § 7 marketing plans for integrating 'value added' products (coffee, cardamom, certified wood and milk products) in 7 sites into commercial chain operating in the region. § Country, linked with market niches in industrialized countries (fair trade, green markets) § Cooperative agreements with AGEXPRONT and AGER or certification entities such as Mayacert to market local community production | <ul style="list-style-type: none"> § At least 3 fair trade/green market organizations in Central America, EU, US or Japan sign business contracts § At least 50,000 USD per year are representing turnover for the communities concerned and secured. § Cardamom processing RE increases value of crop by 50% § 4 GWh are produced each year by the year 3.5 and sold in order to secure O&M cost and reserves | <ul style="list-style-type: none"> § Marketing strategy documents § MoUs between communities AGEXPRONT and AGER or Mayacert, stating product allocations § Business contracts with wholesalers/distributors in US, Europe and Japan | <ul style="list-style-type: none"> § Participation and interest from organizations, such as AGER, AGEXPRONT, Mayacert confirmed. § Sale price of cardamom and coffee stay at the lower end of the scale \$50 / bushel for coffee and \$25 / bushel of cardamom |
| 1.2 Development of off-grid micro hydro (and solar energy) | <ul style="list-style-type: none"> § No feasibility studies. § MAGA concentrates on agriculture without emphasizing energy as a key process input. § No modern energy available. | <ul style="list-style-type: none"> § 5 feasibility studies completed. § Financing sources in place. § MAGA integrates RE within its own project planning. § MAGA dedicates substantial funding for PURE § Construction of mini hydro in 4 - 5 sites § Local tariff and fee system is agreed upon and (should at | <ul style="list-style-type: none"> § Business plans for mini hydro development at 7 selected sites as well as for solar energy for selected applications (crop drying, PV lighting) § MoUs with co-financing partners and financial closure of project implementation | <ul style="list-style-type: none"> § Feasibility study documents, engineering layout and blueprints, business plans and general project documents § Signed contracts for construction of plants § Communities and enterprises that have access to energy § Project and legal | <ul style="list-style-type: none"> § Interest, participation and commitment of local groups, especially the Mayan language speakers § Involvement of municipal government § Local governance and democracy is functional § Land tenure secures |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|--|--|--|--|---|--|
| | | <ul style="list-style-type: none"> least cover O&M cost and possibly river basin environmental cost) | <ul style="list-style-type: none"> § At least 10 installations of other RETs (solar PV systems, solar water pumps and/or solar dryers) | <ul style="list-style-type: none"> documentation available § MoUs between private developers, municipalities and local communities to allow project development on their land | <ul style="list-style-type: none"> development sites |
| 1.3 Increased capital mobilization for PUE lending | <ul style="list-style-type: none"> § Micro credit institutions continue to focus their activities on relatively less marginalized areas in Guatemala. § The poverty belt remains as such. § No micro credit institution attracted to area due to lack of risk guarantee | <ul style="list-style-type: none"> § Financial assessment of lending organizations, lending opportunities and financial delivery models § Micro-finance guidelines for PUE produced and distributed § At least two Eols signed with micro-finance institutions § Commitment between MFIs and 10-15 local communities by year 1 (including the 11 off-grid project sites and communities near the 13 on-grid sites) § Extension of grant to NGO(s) with micro finance experience (such as CDRO, FCG and FUNDAP). § Agreement extending \$200,000 in micro credits for PUE are signed. | <ul style="list-style-type: none"> § MoU signed with MAGA (and CONAP, INAB) for co-financing, focusing on and RETs for PUE in communities (at least 75% Mayan language speakers) § Two international donors provide co-financing through local organizations for PUE activities Minimum 350 000 US\$. § GEF financing of \$ 265,000 leverages at least \$ 1 million for PUE by yr 3 § Other spin-off activities develop in informal sector. At least 10 shops are fully functioning in each community. Local social events every month. § Local credit extended for PUE reaches 2,000,000 US\$. § At least 4 FI officers operate | <ul style="list-style-type: none"> § Document on micro finance guidelines and instruments for PUE § Attendance lists of workshop and public dissemination for a § MoU signed between project and MAGA § MoUs signed between project and NGO(s)/financial institutions that § Financial institution lending for productive uses in communities that have gained access to electricity | <ul style="list-style-type: none"> § Effective local organizations § Support from MAGA, PPP to co-financing confirmed § Willingness of international cooperation agencies to provide co-financing § Effective participation of financial institutions (FCG, BANRURAL, FUNCAFE, CDRO, FUNDAP) |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|--|--|--|--|---|--|
| 1.4 Local capacity building and small business development | <ul style="list-style-type: none"> § RE development remains divided and independent from other MAGA activities § No local capacity to build, operate, and maintain RE. | <ul style="list-style-type: none"> § 'Good practices' manual adapted to target group distributed. § Training for trainers: at least 50 staff trained from government (MAGA, CONAP and INAB) as well as staff from NGOs and local government and § 50 'businesses' are trained in RE with application for 'value added' products of goods and services organizations | <ul style="list-style-type: none"> § Capacity building program for trainers in place at URL University. 30 new students every year. On site training integrated. § Training and workshops (capacity building) for technical project implementation, O&M and energy enterprise management and financ e. Local organizations involved and legalized to operate and maintain RETs in 7 sites (including the 11 off -grid project sites). § 30 entrepreneurs had of local organization producing high value added goods with RE in project site are able to develop business plans. | <ul style="list-style-type: none"> § URL university staff working on R&D and elaboration of capacity building program § Manuals and other capacity building materials § Maya field workers receive a diploma as PUE trainer extended by URL § Number of male and female community members and municipality officers trained | <ul style="list-style-type: none"> § Leadership of URL § Interest, participation and commitment of local groups § Active participation of local governments |
| 1.5 Review of technology support system for hydro and other RETs | <ul style="list-style-type: none"> § No information on providers, quality of technology prices or O&M requirement. | <ul style="list-style-type: none"> § Technology gap assessment available, shared and validated by all professionals. § Gap closure strategy designed. | <ul style="list-style-type: none"> § Report containing assessment of the RET support system and commercialization of RETs <p>Technology gap does not exist as a barrier to RE development. Reliability factor: 90%. Availability of spare parts in less than 1</p> | <ul style="list-style-type: none"> § Project Report | |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|--|---|--|--|--|---|
| | | | week at project site. Availability of qualified staff. | | |
| OUTCOME 2 Development of 13.5 MW of Grid-connected Private Sector RET (small hydro) | § No private RE development in project area. | <ul style="list-style-type: none"> § 6 MW operating. § Co-financing secured for a total of 6 MW. § Benefit sharing agreement in place. Use of 1M private co-financing agreed upon. § Local institutional set up in place. | <ul style="list-style-type: none"> § At least 13.5 MW of on-grid RET operational § About US\$ 47 million is committed for investment from private and public sources. § About 13 locally based energy firms operating. § At least 10% of energy produced used by local communities for private, social and PU. § MAGA's National Rural development Program cooperating with PURE for the use of RETs in forestry and agriculture activities | <ul style="list-style-type: none"> § Project and official documentation (feasibility studies, business plans, MoUs, contracts) § Opening of bank accounts for each off-grid facility to allow for project development and fee collection | <ul style="list-style-type: none"> § Political stability allows for investment in rural areas § There is strong municipal support the RET projects as well as strong involvement of the community as a sense of ownership and income generation opportunity § EIAs identify all activities that can be implemented by river basin committees |
| 2.1 Development of grid-connected mini hydro | § No development of small grid connected hydro projects | <ul style="list-style-type: none"> § Feasibility studies for the generation of 6 MW at 5 sites added to the project baseline by end project Year 2. § Business and financial plans for 4 small hydro development activities § Construction of grid-connected small hydro at 4 sites by yr 3 | <ul style="list-style-type: none"> § 13.5 MW produces at least 40 gigawatt-hours (GWh) § Local energy business operating in a sustainable manner. § Local sales and benefit sharing contracts and national PPAs ensure financial sustainability. § 7,500 persons have access to electricity in project area. | <ul style="list-style-type: none"> § Feasibility study documents § Business plan documents § Financial agreements and reports. § MoU between developers, financiers and operator (provider) | <ul style="list-style-type: none"> § Insecure land tenure might threaten best development sites § Municipal governments and communities have a sense of 'ownership' § Involvement of AGER § Price of fossil fuels remains high |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|--|--|---|--|---|---|
| 2.2 Development of Productive Uses | <ul style="list-style-type: none"> § Indigenous and non-indigenous communities have few or no productive of energy | <ul style="list-style-type: none"> § 7 marketing plans for integrating 'value added' products (coffee, cardomon, certified wood and milk products) in 10 sites into commercial chain operating in the region. § Country, linked with market niches in industrialized countries (fair trade, green markets) | <ul style="list-style-type: none"> § Turnover for PU other than energy equals at least 200,000 USD per year and secured for 5 years.. § Value added equals 40% of product value. | <ul style="list-style-type: none"> § Project reports § Financial statements. § Local statistics. | <ul style="list-style-type: none"> § Value for base products is US\$50/b coffee and US\$25/b in cardamom § General security and safety in the rural areas allows the development of productive uses of energy |
| 2.3 Stakeholder engagement and environmental good practices in small-scale hydro development | <ul style="list-style-type: none"> § No engagement and environmental practices in watershed. § Tons of wood used per year increases without reforestation schemes. | <ul style="list-style-type: none"> § Consultations with rural communities, municipality and watershed management committee). Local institutions and stakeholders agree upon parameters of insertion of projects and agree on monitoring and co-management parameters § 3 agreements signed between private developer and municipalities and local organizations § MoU between stakeholders, ANG and the project on technical assistance and capacity building activities | <ul style="list-style-type: none"> § At least 12-20 capacity building sessions where private developers, local governments and grassroots organizations have acquired necessary skills § Basis of the agreement provides each party with satisfactory benefits. If not, agreements have been changed.. § Private developers are actively looking for additional locations § Watershed maintained at least in a state suitable for hydro plant sustainability and PU development. . | <ul style="list-style-type: none"> § MoU between stakeholders, ANG and the project on technical assistance and capacity building activities (documentation and progress reports) § MoU between project partners and stakeholders § Survey for mid project and project end. | <ul style="list-style-type: none"> § Participation and interest of population at the selected project sites § Interest of private investors and of financing agencies |
| OUTCOME 3 Sustainable Natural | <ul style="list-style-type: none"> § Continuing unsustainable use of local resources. | <ul style="list-style-type: none"> § Long-term watershed management plans | <ul style="list-style-type: none"> § Strengthened river basin social organizations (at least | <ul style="list-style-type: none"> § Project documentation and manuals | <ul style="list-style-type: none"> § Environmental groups, NGOs and |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|---|--|--|--|---|---|
| and Energy Resources Management in River Basins | <ul style="list-style-type: none"> § Vegetation cover ratio is 50% and degrading by 5.% each year. § 0 hectares sustainable managed § No link between RE based PUE and sustainable management and no integration of adaptation measure in investment. | <ul style="list-style-type: none"> implemented in at least 4-7 areas by year 3 § Stable vegetation cover situation attained in at least 50% of project location. § 50% of land managed in a sustainable manner in project area equivalent to 30,000 hectares § Specific CC related provisions in investment plans and best practice development.. § Impact of extreme climate event is limited in project area. | <ul style="list-style-type: none"> 4-7 river basin management committees) § Improved soil and water quality in ecologically sensitive areas of at least 7 micro-river basins. Stabilization in all sites and improvement in at least 25% of sites (equaling 40,000 ha stabilized and 10,000 ha improved). § MAGA's projects cooperating with PURE by providing of up to \$ 8.5 million for the use of RETs in forestry and agriculture activities | <ul style="list-style-type: none"> § Local workshop proceedings § MAGA reporting. § Local agricultural and forestry statistics | <ul style="list-style-type: none"> municipalities at local and national level are fully informed thus reducing unnecessary red tape § Potential conflicts regarding shared watersheds between municipalities are minimized § Watershed management concepts can be fused with local knowledge and customs |
| 3.1 Local enabling environments for participatory watershed management integrated with natural resources management for RE generation and vulnerability aspects | <ul style="list-style-type: none"> § Watershed management does not exist under poverty constraints . § CC translates into external events resulting in local disasters. | <ul style="list-style-type: none"> § Assessments performed of natural resources management, practices in agriculture and forestry and vulnerability (including threats analysis of soil erosion, forest, freshwater ecosystem) in at least 7 micro-river basins (including the on-grid and off-grid project sites. § Framework for watershed management, vulnerability prevention and stakeholder involvement is formulated | <ul style="list-style-type: none"> § At least 4 specialized organizations are active on project site. § At least 7 river basin committees are legally incorporated (including the on-grid and off-grid project sites § At least 40% of the people involved in the design and implementation of the watershed plans § 4-7 watershed plans for | <ul style="list-style-type: none"> § Documents, showing number of villages and land area under integrated river basin plans, covering watershed conservation, natural resource management and disaster response plans § Signed subcontracts for technical assistance activities | <ul style="list-style-type: none"> § Active interest and participation of local Mayan communities, including women § Level of education is sufficient to introduce integrated watershed management concepts § Leadership of subcontracted organizations, municipal government |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|---|--|---|--|---|---|
| | | <ul style="list-style-type: none"> § Documented implementation of framework in at least 5 sites. § 7 river basin committees legally incorporated. § 4-7 watershed plans for management of natural resources (land use, agriculture, forestry, animal husbandry, fresh water), RE generation and/or disaster prevention are developed by the end of year 2 § At least 25% of the people (of which at least 2/3 indigenous) involved in the design of the watershed plans | <p>management of natural resources (land use, agriculture, forestry, animal husbandry, fresh water), RE generation and/or disaster prevention are implemented.</p> | | |
| 3.2 Better management practices in agriculture, forestry and animal husbandry | <ul style="list-style-type: none"> § MAGA is supporting sustainable management without integrating energy aspects. § No local management plans integrate energy aspects. | <ul style="list-style-type: none"> § Management practice are visibly integrating the benefits of RE in at least 5 locations. § Communication campaign in Mayan languages designed by year 1 and disseminated § Information exchange and at least 15-25 culturally appropriate workshops that identify traditional knowledge with production schemes using high-tech options training between MAGA and project staff and local communities | <ul style="list-style-type: none"> § Management practice are visibly integrating the benefits of RE in at least 7 locations § 40% increased production and productivity due to better management practices and energy use § Energy use replaces biomass uses for 60% of related activities in all project sites § Wood resource conserved equals at least 500 m³ per year (replaced by RE | <ul style="list-style-type: none"> § MAGA project monitoring and evaluation reports § Radio clips, brochures, posters, local fairs § Workshop materials and attendance lists § Local agricultural and forestry statistics | <ul style="list-style-type: none"> § Leadership of MAGA § Participation of local communities § Effective communication and coordination with INAB, CONAP and URL |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|--|---|---|--|--|---|
| | | | processing) | | |
| OUTCOME 4 Conditions for project replication are established (including policy and regulatory proposals); monitoring, learning and evaluation | § Within policies, PU is not associated to RE. | § Outreach efforts, workshops, publications that disseminate project-relevant information and lessons learned § Official ministry statements on policy and regulation promoting off-grid, RET and PUE § Demonstrated adaptive management based on monitoring. | § Coordination between various ministries established. § Identification of future sites to implement project approach: Minimum: 60 isolated sites for the next 5 year after project closure. § Partnership with other donors established. Funds leveraged for replication: 20 million USD at project's end | § Project publications § Legal documentation (MEM, MARN, MAGA) § Laws, by-laws and regulations published in the official gazette | § Relevant ministries (MEM, MARN, MAGA) are committed to off-grid § Political scenario allows cooperation between the various ministries |
| 4.1 Monitoring, learning, feedback and evaluation | § Indicators are not site specific and not even region specific. § Their complexity prevents optimum use at reasonable cost. § Data is difficult to obtain for trust issues. § At least 3 case studies reporting on poverty alleviation, sustainable energy and vulnerability reduction from experiences in 3 RET projects of PURE § Revised Project Document | § Specific and simple indicators relevant for PU based on RE are developed shared and agreed upon. § Indicators developed in other initiatives for adaptation are applied to the PURE project § PMU established and operational | § Project impacts are monitored and disseminated. § Official publications at regional level at least use project monitoring tools. § Case study reporting on poverty alleviation, sustainable energy and vulnerability reduction from experiences in 10 RET projects of PURE § At least 3 national Workshops and seminars with at least 60 participants have allowed informed exchanges and dissemination of information. | § Documents § Workshop and seminar proceedings § Annual work plans; APRs; quarterly progress and financial reports | § MARN leadership |

| PROJECT STRATEGY (Objectives, outcomes, outputs) | Baseline Indicator | Mid-term Indicator | Final Indicator | Sources of verification | Assumptions/risks |
|---|--|---|---|--|---|
| 4.2 Enabling environment proposed of regulatory instruments for independent small-scale hydropower producers | <ul style="list-style-type: none"> § Although the law on distributed electricity has been approved, regulations and instruments to apply the new law are not in place. § Transaction costs represent 30% of investment cost. | <ul style="list-style-type: none"> § Clear and fair rules of the game are established and agreed upon by all parties concerned . § Transactions reach 20% of investment costs. | <ul style="list-style-type: none"> § The 13 new grid connected plants are under this clear framework. § Transaction costs reach 10% of investment costs. § The GoG is permanently improving the legal and regulatory framework to share benefits of the existing RE potential. | <ul style="list-style-type: none"> § Laws and by-laws that allow the policy framework to be implemented § Workshop and seminar proceedings | <ul style="list-style-type: none"> § Fossil fuel market price continue to rise, making RE more competitive § MEM and MARN leadership § Active participation by ANG and CNEE § Political stability |
| 4.3 Proposed policy directives on off-grid rural energy provision with mini/micro hydropower and solar energy | <ul style="list-style-type: none"> § Rural electrification and PU are disconnected. | <ul style="list-style-type: none"> § A plan to integrate RE and PUE is presented and discussed with GoG. | <ul style="list-style-type: none"> § A framework for off-grid RET and PUE is proposed to be incorporated into the national energy policy by year 3 | <ul style="list-style-type: none"> § Laws and by-laws that allow the policy framework to be implemented § Workshop and seminar proceedings | <ul style="list-style-type: none"> § Fossil fuel market price continue to rise, making RE more competitive § MEM, MAGA and MARN leadership § Political stability |
| 4.4 Improved policy dialogue on the linkages between energy supply, rural development, adaptation and natural resources | <ul style="list-style-type: none"> § GVEP is the only forum for an inter-sectoral dialogue. § Sustainability of GVEP is not secured. | <ul style="list-style-type: none"> § GVEP is continuing to identify potential sites for energy for development purposes. § GVEP becomes the forum for decision making. Advice from project steering committee and advisory body is sought every 6 months. | <ul style="list-style-type: none"> § At least 2 policy statements at the national level, linking climate change mitigation, adaptation and rural development § Various ministries are continuing to join their efforts to alleviate poverty mitigate climate change and its impacts within GVEP or not. | <ul style="list-style-type: none"> § Official communications § Workshop and seminar proceedings | <ul style="list-style-type: none"> § Participation of CONRED § Political stability |

SECTION C. PROJECT BUDGET

a) GEF AND CO-FINANCING BUDGET, PER OUTCOME AND OUTPUT

| Outcomes | TOTAL (USD) | GEF | Co financing In-kind | Co financing Cash | Source of cash co financing | | | | | Leveraged funding |
|---|-------------------|------------------|----------------------|-------------------|-----------------------------|------------------|------------------|------------------|----------------|-------------------|
| | | | | | GoG (MAGA) | GoG (MEM) | Municipalities | AGER | FunSolar | |
| 1 Development of off -grid RET and PUE | 7,015,909 | 979,305 | 60,000 | 5,976,604 | 4,976,604 | 400,000 | 600,000 | | | 8,700,000 |
| 2 Development of on -grid RET and PUE | 4,563,219 | 647,415 | 45,000 | 3,870,804 | 1,970,804 | 500,000 | 400,000 | 1,000,000 | | 47,250,000 |
| 3 Sustainable natural & energy resources | 1,337,092 | 254,500 | 30,000 | 1,052,592 | 1,052,592 | | | | | |
| 4 Replication; monitoring, learning , eval. | 658,780 | 518,780 | 40,000 | 100,000 | | 100,000 | | | | |
| Project management unit | 475,000 | 150,000 | 325,000 | | | | | | | |
| TOTAL | 14,050,000 | 2,550,000 | 500,000 | 11,000,000 | 8,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 0 | 55,950,000 |
| PDF-B | 278,000 | 100,000 | 28,000 | 150,000 | | | | | | 150,000 |
| Total including PDF-B | 14,328,000 | 2,650,000 | 528,000 | 11,150,000 | 8,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 150,000 | 55,950,000 |

| Outcomes and Outputs | TOTAL (USD) | GEF | Co financing In-kind | Co financing Cash | Source of cash co financing | | | | |
|--|-------------------|------------------|----------------------|-------------------|-----------------------------|------------------|------------------|------------------|-------------------|
| | | | | | GoG (MAGA) | GoG (MEM) | Municipalities | AGER | Total |
| 1. Development of off -grid RET and PUE | 7,015,909 | 979,305 | 60,000 | 5,976,604 | 4,976,604 | 400,000 | 600,000 | | 6,036,604 |
| 1.1 Local product development | | 272,249 | | | 1,467,578 | 400,000 | | | |
| 1.2 Development of 1.5 MW of off -grid RET | | 165,697 | | | 2,087,547 | | | | |
| 1.3 Capital mobilization | | 185,575 | | | 1,421,479 | | | | |
| 1.4 Capacity building & business develop. | | 205,357 | | | | | | | |
| 1.5 RET technology support system | | 150,427 | | | | | | | |
| 2. Development of on -grid RET | 4,563,219 | 647,415 | 45,000 | 3,870,804 | 1,970,804 | 500,000 | 400,000 | 1,000,000 | 3,915,804 |
| 2.1 Development of 13.5 MW on -grid RET | | 269,717 | | | | 500,000 | | 1,000,000 | |
| 2.2 Development of product ve uses | | 197,908 | | | 1,970,804 | | | | |
| 2.3 Stakeholder engagement | | 179,790 | | | | | | | |
| 3. Sustainable natural & energy resources | 1,337,092 | 254,500 | 30,000 | 1,052,592 | 1,052,592 | | | | 1,082,592 |
| 3.1 Integrated watershed management | | 179,890 | | | 576,895 | | | | |
| 3.2 Improved agrosilvocultural practices | | 74,610 | | | 475,697 | | | | |
| 4. Replication, monitoring, learning, eval. | 658,780 | 518,780 | 40,000 | 100,000 | | 100,000 | | | 140,000 |
| 4.1 Monitoring, learning, feedback & eval.* | | 135,000 | | | | | | | |
| 4.2 Regulatory measures | | 103,496 | | | | 60,000 | | | |
| 4.3 Rural and RE policy | | 122,598 | | | | 40,000 | | | |
| 4.4 Policy dialogue | | 157,686 | | | | | | | |
| Project Management | 475,000 | 150,000 | 325,000 | | | | | | 325,000 |
| TOTAL | 14,050,000 | 2,550,000 | 500,000 | 11,000,000 | 8,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 11,500,000 |

* According to the M&E Plan

Note: Of the above amount, \$40,000 of GEF funding and \$150,000 of co-financing is allotted to national and international travel. International travel consists of international consultants traveling to Guatemala to provide technical assistance. National travel consists of technical assistance, project management, and project monitoring missions. This is the bulk of the travel budget, since the project will work in dispersed, remote locations of rural Guatemala, which will require substantial deployment of staff to the field on short and long term missions.

b) ATLAS TOTAL BUDGET AND WORK PLAN

| Award ID: | | Proposal: 00043790—Project:00051216 | | | | | | | |
|--|----------------------------|---|---------------------------|--------------------------------|---------------------|---------------------|---------------------|---------------------|------------------|
| Award Title: | | PIMS 3186 CC FSP PURE | | | | | | | |
| Business Unit: | | GTM10 | | | | | | | |
| Project Title: | | PIMS 3186 Productive Uses of Renewable Energy in Guatemala (PURE) | | | | | | | |
| Executing Agency: | | Fundacion Solar | | | | | | | |
| GEF Outcome / Atlas Activity | Resp. Party (Impl. Agency) | Fund ID / Donor name | Atlas Budget Account Code | ATLAS Budget Description/Input | Amount (USD) Year 1 | Amount (USD) Year 2 | Amount (USD) Year 3 | Amount (USD) Year 4 | Total (USD) |
| Outcome 1 Development and promotion of 1.5 MW off-grid technologies for productive uses of energy (PUE) | Fundacion Solar | 62000 GEF | 71200 | International Consultants | 15,000 | 15,000 | 15,000 | 15,000 | 60,000 |
| | | | 71300 | Local Consultants | 71,500 | 95,000 | 75,000 | 49,805 | 291,305 |
| | | | 71600 | Travel | 2,000 | 2,000 | 2,000 | 2,000 | 8,000 |
| | | | 72200 | Equipment and furniture | 30,000 | 22,000 | 23,000 | 20,000 | 95,000 |
| | | | 72500 | Supplies | 11,000 | 10,000 | 9,000 | 9,500 | 39,500 |
| | | | 72800 | Info. Technology Equipment | 14,500 | 4,500 | 4,500 | 4,500 | 28,000 |
| | | | 73100 | Rental & Maint. - Premises | 16,000 | 16,000 | 16,000 | 14,000 | 62,000 |
| | | | 73400 | Rental & Maint. - Equip. | 15,000 | 15,000 | 15,500 | 15,000 | 60,500 |
| | | | 71400 | Contractual Services | 50,000 | 50,000 | 50,000 | 50,000 | 200,000 |
| | | | 72300 | Materials & Goods | 20,000 | 25,000 | 21,000 | 20,000 | 86,000 |
| | | | 74200 | AV & Printing Production cost | 10,000 | 4,000 | 1,000 | 1,000 | 16,000 |
| 74500 | Miscellaneous Expenses | 10,000 | 10,000 | 8,000 | 5,000 | 33,000 | | | |
| sub-total | | | | | 265,000 | 268,000 | 240,000 | 205,805 | 979,305 |
| Outcome 2: Development of 13.5 MW and promotion of grid-connected RET (mini hydropower) | Fundacion Solar | 62000 GEF | 71200 | International Consultants | 12,000 | 10,000 | 9,000 | 9,000 | 40,000 |
| | | | 71300 | Local Consultants | 72,000 | 73,000 | 60,000 | 66,000 | 271,000 |
| | | | 71600 | Travel | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| | | | 72200 | Equipment and furniture | 11,000 | 14,000 | 10,000 | 10,000 | 45,000 |
| | | | 72500 | Supplies | 12,200 | 8,600 | 3,000 | 1,300 | 25,100 |
| | | | 72800 | Info. Technology Equipment | 9,600 | 1,000 | 1,000 | 1,000 | 12,600 |
| | | | 73100 | Rental & Maint. - Premises | 10,000 | 6,500 | 6,000 | 5,000 | 27,500 |
| | | | 73400 | Rental & Maint. - Equip. | 8,000 | 7,000 | 9,000 | 8,000 | 32,000 |
| | | | 71400 | Contractual Services | 17,000 | 19,000 | 15,000 | 17,000 | 68,000 |
| | | | 72300 | Materials & Goods | 23,000 | 25,215 | 20,000 | 18,000 | 86,215 |
| | | | 74200 | AV & Printing Production cost | 2,000 | 2,000 | 8,000 | 2,000 | 14,000 |
| 74500 | Miscellaneous Expenses | 5,000 | 6,000 | 6,000 | 5,000 | 22,000 | | | |
| sub-total | | | | | 182,800 | 173,315 | 148,000 | 143,300 | 647,415 |
| Outcome 3: Sustainable natural and energy resources management in river basins | Fundacion Solar | 62000 GEF | 71200 | International Consultants | 6,000 | 12,000 | 12,000 | 10,000 | 40,000 |
| | | | 71300 | Local Consultants | 18,000 | 30,000 | 22,000 | 7,000 | 77,000 |
| | | | 71600 | Travel | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| | | | 72200 | Equipment and furniture | 4,000 | 2,000 | 5,000 | 4,000 | 15,000 |
| | | | 72500 | Supplies | 10,000 | 4,000 | 4,000 | 4,000 | 22,000 |
| | | | 72800 | Info. Technology Equipment | 10,000 | 1,000 | 1,000 | 1,000 | 13,000 |
| | | | 73100 | Rental & Maint. - Premises | 4,000 | 4,500 | 6,000 | 2,000 | 16,500 |
| | | | 73400 | Rental & Maint. - Equip. | 4,000 | 2,000 | 2,000 | 6,000 | 14,000 |
| | | | 71400 | Contractual Services | 10,000 | 9,000 | 10,000 | 10,000 | 39,000 |
| | | | 74200 | AV & Printing Production cost | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| | | | 74500 | Miscellaneous Expenses | 3,500 | 2,000 | 2,000 | 2,500 | 10,000 |
| sub-total | | | | | 71,500 | 68,500 | 66,000 | 48,500 | 254,500 |
| Outcome 4: Conditions for project replication are established; monitoring, learning and evaluation | Fundacion Solar | 62000 GEF | 71200 | International Consultants | 25,000 | 30,000 | 25,000 | 30,000 | 110,000 |
| | | | 71300 | Local Consultants | 35,500 | 52,500 | 35,964 | 46,536 | 170,500 |
| | | | 71600 | Travel | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| | | | 72200 | Equipment and furniture | 9,000 | 5,000 | 15,000 | 10,280 | 39,280 |
| | | | 72500 | Supplies | 4,000 | 4,000 | 4,000 | 4,000 | 16,000 |
| | | | 72800 | Info. Technology Equipment | 10,000 | 1,000 | 1,000 | 1,000 | 13,000 |
| | | | 73100 | Rental & Maint. - Premises | 5,000 | 6,000 | 5,000 | 7,000 | 23,000 |
| | | | 73400 | Rental & Maint. - Equip. | 4,000 | 5,000 | 5,000 | 5,000 | 19,000 |
| | | | 71400 | Contractual Services | 21,000 | 17,000 | 20,000 | 20,000 | 78,000 |
| | | | 74200 | AV & Printing Production cost | 6,000 | 6,000 | 7,000 | 10,000 | 29,000 |
| | | | 74500 | Miscellaneous Expenses | 4,000 | 4,000 | 4,000 | 5,000 | 17,000 |
| sub-total | | | | | 124,500 | 131,500 | 122,964 | 139,816 | 518,780 |
| Project Management Unit | Fundacion Solar | 62000 GEF | 71300 | Local Consultants | 25,000 | 25,000 | 25,000 | 25,000 | 100,000 |
| | | | 71600 | Travel | 5,000 | 5,000 | 5,000 | 5,000 | 20,000 |
| | | | 72200 | Equipment and furniture | 3,000 | 0 | 0 | 0 | 3,000 |
| | | | 72500 | Supplies | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| | | | 72800 | Info. Technology Equipment | 5,000 | 0 | 0 | 0 | 5,000 |
| | | | 73100 | Rental & Maint. - Premises | 2,500 | 2,500 | 2,500 | 2,500 | 10,000 |
| | | | 73400 | Rental & Maint. - Equip. | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| | | | 74500 | Miscellaneous Expenses | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 |
| sub-total | | | | | 43,500 | 35,500 | 35,500 | 35,500 | 150,000 |
| TOTAL | | | | | 686,800 | 674,815 | 606,464 | 581,921 | 2,550,000 |

**SECTION D. STUDY ON PRODUCTIVE USES OF RENEWABLE ENERGY IN
GUATEMALA**

The results of the studies and assessment undertaken in the PDF B phase of PURE are summarized in the publication 'Productive Uses of Renewable Energy (PURE) in Guatemala'.

UNDP/GEF Project

**PRODUCTIVE USES OF RENEWABLE ENERGY
(PURE) IN GUATEMALA**

**Assessment of productive uses (coffee, cardamom, wood, ecotourism) and social
uses of renewable energy (micro hydropower)**

Prepared for Fundación Solar and United Nations Development Program by:

Date: October 2006



- 1 Las Conchas
- 2 Jolom Ijix
- 3 Seasir
- 4 Chel

MAPNO 2864, June 1994. Cartographic Service of the UNITED NATIONS

ABBREVIATIONS

| | |
|-----------------|---|
| AGEXPORT | Association of Exporters |
| AGER* | Association of Rural Entrepreneurs |
| AGER* | Association of Renewable Energy Generators |
| ANACAFE | National Coffee Association |
| BANRURAL | Rural Development Bank |
| CNEE | National Commission on Electricity |
| COCODES | Community Development Council |
| COMODES | Municipal Development Council |
| FONAPAZ | National Trust Fund for Peace |
| FUNCAFE | Foundation for Coffee Development |
| FUNDAP | Foundation for the Development of the Highlands |
| IFAD | International Fund for Agricultural Development |
| INAB | National Institute of Forestry |
| GEF | Global Environmental Facility |
| GHG | greenhouse gas |
| GVEP | Global Village Energy Partnership |
| INDE | National Institute for Electrification |
| INFOM | National Institute of Municipal Development |
| MAGA | Ministry of Agriculture, Livestock and Food |
| MARN | Ministry of Environment and Natural Resources |
| MAYACERT | Certifying Agency of Organic Products |
| MEM | Ministry of Energy and Mines |
| MHP | mini/micro hydropower |
| PINFOR | Forestry Incentives Programme |
| PUE | productive uses of energy |
| PURE | productive uses of renewable energy |
| PV | photovoltaic |
| RE | renewable energy |
| RET | renewable energy technology |
| SME | small and medium scale enterprises |
| UNDP | United Nations Development Program |

Exchange rate

US\$ (US dollar) 1 = Q (Quetzal) 7.9 (October 2006). This rate has been used to convert quetzals into dollars in the calculations presented in the tables of this report, unless stated otherwise.

*AGER is used twice as an acronym of two different trade associations.

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4. INTRODUCTION AND EXECUTIVE SUMMARY

4.1 Background

154. The Full Size Project Proposal “Productive Uses of Renewable Energy (PURE)” was approved by the Council during the February 2005 Inter-sessional Work Program, consisting of an GEF Executive Summary and a Project Document in the format of the United Nations Development Program (UNDP). However, given the fact that the proposal was prepared without any preparatory assistance from GEF (PDF³⁴), the GEF Secretariat, UNDP and Fundación Solar agreed that it was best to undertake some further project preparation activities to address the following issues:
- Definition by means of market assessments of the proposed additional income generated for end users of RETs as a result of productive uses and business models for development of small and medium enterprises (SMEs) that profit from productive uses of renewable energy
 - Clarification of financial sustainability of the projects (including delivery models for renewable energy that cover technology investment and operation and maintenance costs)
 - Detailed coordination arrangements between the UNDP/GEF initiative and other GEF and non-GEF funded projects described in the Executive Summary and inclusion of monitoring of economic activity in project areas of intervention in the monitoring and evaluation (M&E) plan.
155. A PDF-B proposal was then formulated with four main activities with the goal to meet all requirements for endorsement by the GEF Secretariat’s Chief Executive Officer (CEO):
- Market assessments of products that generate additional income generation for end users and business models for small and medium enterprises that profit from productive uses of energy;
 - Development of financial sustainability of renewable energy projects, including delivery models for renewable energy services (covering investment and operation and maintenance cost);
 - Definition of coordination mechanisms with other GEF and non GEF funded projects;
 - Preparation of the final UNDP Project Document (for CEO endorsement)
156. Out of the approved US\$ 2.65 million budget approved by GEF for PURE Guatemala, US\$ 100,000 was given as GEF PDF B support to carry out the above-mentioned main activities. The PDF B activities were carried out during the first half of 2006, focusing on the communities of Chel (organization and business plan for the local hydropower facility), Las Conchas (ecotourism), Seasir (coffee and sustainable timber production) and Jolom Ijix (cardamom). The reader should note that, during the course of PURE, a more detailed feasibility analysis of the hydropower facilities will be made of the four sites, while also the potential of other sites for the development of run-on-the-river off-grid facilities will be explored. A full list of project sites that will be considered in PURE Guatemala is given in Annex A.
157. This report provides a summary of the main results and findings of these first four studies (financed under the GEF PDF B) and consists of three parts:
- Description of the four project areas included in the PDF B market assessment
 - Short introduction to the electricity sector of Guatemala
 - Market studies and business models for the development of value-added productive chains in the four project areas
 - Assessment and business models for the delivery of renewable energy services for social and productive uses in the selected four areas.

³⁴ Project Preparation and Development Facility

4.2 Problem description and strategy of the PURE project

158. The agricultural and agro-industrial sectors play a central role in the economy of Guatemala. These sectors are characterized by inefficient and inadequate energy use, mainly of oil-based fuels, traditional biomass and animal and human energies. This reduces productivity, increases production costs and leads to environmental and human health problems that add stress to agriculture, to the natural resource base and to society. Despite the availability of natural resources and the existence of technologies to tap their energy potential, as in most of the developing world, the widespread adoption of renewable energy for productive uses has not been achieved in rural Guatemala. Main reasons for this problem are the poverty trap, which does not enable low-income, often indigenous, people to invest capital upfront, and the failure of government assistance to incorporate new communities into a market economy (through productive uses of energy).
159. While renewable energy (RE), especially small-scale hydropower³⁵, has the potential to fulfill the energy needs of households and in agricultural production systems in off-grid areas, the widespread application of these technologies is currently hampered by a number of social-institutional, cultural, policy-regulatory, information, market-financial and cultural barriers. These barriers maintain a business-as-usual situation in which rural communities do not have the financial capability to access new technologies, while lack of energy and other infrastructure severely limits the development of new income-generating productive activities.
160. Access to even limited amounts of electricity for small enterprises that are not grid-connected can be important in the establishment and growth of these businesses. Electric power can have the following positive effects on local economic activities:
- *Extending operating hours* – Renewable energy systems can provide lighting to allow shops to extend the working day and workshops to increase production;
 - *Working conditions* – A fluorescent lamp gives much better lighting than a gas lamp or kerosene wick for tasks such as reading, sewing, writing, etc.
 - *Mechanization* – Electricity to run a motor can transform a manual subsistence activity into a more sustainable business;
 - *Product preservation* – Electricity can help in drying crops and preserving perishable products, such as meats or fruits;
 - *Communications* – Cellular phones allow micro entrepreneurs to investigate market conditions
 - *Education* – Electricity provides for lighting for reading and writing in the evening hours.
161. PURE's strategy is set up around the extension of agricultural and forestry productive chains in rural Guatemala, using mini/micro hydropower (MHP) as a primary input to the productive process. Energy and freshwater uses for processing local products creates value added to the local economy, by locally processing agricultural and forestry products. More productive uses imply more paying clients of the MHP facility, thus bringing in more revenues, making the system more economically viable.
162. Likewise, access to energy offers a spill-over potential to provide informal sector micro-enterprises (restaurants, workshops) with higher sources of income and community households with higher living standards (improved lighting and water supply). Rather than focusing on providing access to energy as the only project purpose, the PURE project in Guatemala regards MHP (and other RE technologies) as a fundamental input within a larger operational development framework that catalyzes an added value productive chain. Local producers will be linked with national and global markets, securing additional income, thus alleviating poverty in these areas and providing resources to ensure the sustainability of the RE initiatives.
163. Under the PURE Guatemala project umbrella, GEF funds will be used cover the renewable energy barrier removal activities, while the Government of Guatemala (in particular the Ministry of

³⁵ The definition of *small-scale* varies in the international literature, but includes 'small hydropower' (< 5 -15 megawatts, MW), mini hydro (< 1 -5 MW), micro hydro (< 100 -300 kilowatt, kW) and pico hydro (< 1 -5 kW)

Agriculture, Livestock and Food) and private sector partners will cover investment in the renewable energy technology as such, as well as covering the barriers that are not energy related, such as natural resources management, productivity enhancement, certification, micro credit and investment, etc.

4.3 Main findings

Selection of project areas

164. The areas of Chel (in Quiché) and Las Conchas, Seasir and Jolom Ijix (in Alta Verapaz) have been identified as the first four areas for to be included in the PURE initiative of electrification with MHP plants and productive use development. The areas are located in the Guatemala's poorest areas and the population is mainly of Maya origin. A full list of off-grid project areas to be included in PURE Guatemala is given in Annex A.

Market assessment and business plan of productive uses

165. The PURE project will focus on at least 4 productive chains that have been identified by the Government as priorities for their rural development strategies and require energy as a fundamental input for processing. These are coffee, cardamom, sustainable produced wood products and ecotourism.
166. *Coffee* and *cardamom* represent the most important cash crop in the region. The main coffee markets are in North America, Europe and Japan. Cardamom is a spice highly demanded in the Arab world and used as an additive to coffee, food products and perfume. In order to be sold commercially, the crops need proper processing and drying. Farmers process the crops locally or sell the harvested crop directly to intermediaries. Sometimes locally processed coffee has low quality due to inappropriate drying processes. The improved local processing of the crops (instead of selling the harvested or a substandard processed product to intermediaries) will generate additional income in the communities.
167. This requires modern energy inputs for improved processing (e.g., de-pulping, drying, and packaging). Apart from firewood for heating the air, diesel fuel is used in the drying process to drive fans that circulate the hot air. Appropriate renewable energy (RE) technologies for drying are electricity from MHP (replacing the diesel engine) and solar drying (replacing wood). The analysis in this report (focusing on the areas of Seasir and Jolom Ijix) shows that using electricity from a village micro hydropower facility in the processing facility is competitive with using diesel engines for individual applications or a village mini-grid powered by a diesel generator. Applying solar driers will have the positive environmental impact of reducing the consumption of wood that may have been produced in an unsustainable way.
168. While low-quality coffee is being dumped on world markets lowering market prices, the market also seems to be willing to pay for organically grown premium-quality coffee through 'fair trade'. Farmer's associations or cooperatives qualify for fair trade certification. Guatemala also has made substantial advances towards certification of its coffee and cardamom as high value "organic" crops. Production of 'fair trade' and 'organic' products requires better agro-forestry practices and local capacity building in order to raise productivity without resorting to chemical external inputs. Thus, integration of micro hydropower (MHP) with solar or improved biomass coffee dryers to the productive chain has the potential to increase local incomes and produce a high quality crop that can be labeled as "green" and/or "fair" and be sold at a premium price in international markets.
169. *Certified wood products* – As with coffee, Guatemala is making advances in green certification of much of its timber. This requires that wood is produced in sustainable managed forests or in dedicated plantations. An analysis is made in this report of the Seasir area, shows that such a plantation, producing firewood and timber, can be a profitable business at the community level. Furthermore, introduction of modern energy carriers will allow the development of sawmills and carpentry shops to further process the timber, thus increasing the value added retained at the local level. As in the case of coffee, renewable energy technologies can be used on a competitive basis with diesel fueled

technology for the pre-drying of high quality woods (so that it can be exported in optimal conditions) and the local processing of the wood in various wood products.

170. *Ecotourism* – Tourism is increasing in Guatemala. Most of the project sites are located in landscapes that can be developed as ecotourism facilities due to the presence of natural forests, protected areas, waterfalls and endemic species. The case study in this report focuses on the Las Conchas facility which is at a scenic location and some elementary facilities for ‘off the beaten track’ tourists. Upgrading these facilities into of a small eco-resort should be a profitable business. To attract a wider range of tourists, the availability of electricity, e.g. provided by the local MHP station, is essential to provide for lighting and electric appliances.

Model for the implementation of micro hydropower

171. The analysis of the report shows that micro hydropower (MHP) forms the most cost-effective option for energy supply in the target region, suited to the size and scale of investments that can be promoted for supplying energy services to these isolated areas for productive and social uses. A micro-hydro installation will be installed to provide power to nearby communities in a mini-grid system in the four communities selected for the case studies and in other sites that will be included in the PURE project. If needed, the MHP mini-grids can be supplemented by solar thermal for drying of coffee and cardamom and with solar PV for selected isolated applications.
172. The MHP systems of Seasir, Las Conchas and Jolom Ijix are still in the feasibility study stage. However, the MHP in Chel is almost near completion and its organization and construction was supported by Fundación Solar in a participatory process engaging the local community. Some interesting lessons can be learned from this process which was initiated in the year 2000. An integrated approach needs to be followed to promote development in terms of organization and capacity building, social services and infrastructure and productive uses. The main elements of this approach are:
- Inter-institutional coordination with local authorities, community leaders and NGOs active in the area to gain confidence and to achieve a common understanding regarding development and the role of energy services (to be provided by the MHP).
 - Raising political support among the local or regional authorities (municipality, department) is a pre-condition in order to improve road access to the area, so that the inputs need for and the outputs of productive uses of energy can economically arrive in the area.
 - An optimized management structure for a rural power station is best organized locally, in which responsibility and decision making are located as near as possible to the power station and the beneficiaries themselves. The organization scheme promoted by Fundación Solar is that of the Local Organization for the Administration of Energy Projects, known by its Spanish acronym as OLAPE. Legally speaking, an OLAPE can take various forms, e.g. association, cooperative, municipal company, mixed company (in which communities, local authorities, central government and private sector can participate) and private companies. Key concept is the participation of local groups in the development and management of projects, allowing them to share in the costs and the benefits and allowing their organization to attract outside investment. This implies:
 - Awareness creation amongst the beneficiaries and, by means of participatory processes, identification of development priorities, infrastructure needed (including fuels and electricity) and identification of social and productive uses of energy; and
 - This implies strengthening the level of organization in the beneficiary communities by establishing and formalizing village-level associations or cooperatives for the development of productive uses (e.g., coffee producers’ association) and of electricity (e.g., electricity association) and training village leaders so that they are empowered to take their own decisions.
173. A new interesting income generating opportunity for communities is the generation of electricity not for own consumption but for interconnection with and sale to the national grid. For example, after having implemented the 160 kW micro hydropower station for the community’s off-grid power demand, the Chel Hydroelectric Association is now exploring the possibility of developing a 1.4 MW on-grid mini hydropower station. Similarly, in the community of Tacaná, three local organizations (one association, one cooperative and a social club) have joined forces with the local government to raise capital for the development of a 1.8-5 MW on-grid mini hydropower scheme.

174. Such initiatives are interesting as they originate from communities that have proven experience in managing small-scale hydropower schemes themselves, thus reducing business risks. However, it means a step up the energy ladder from kW to MW, implying the need for acquiring new business, management and technical skills.

5. PROJECT AREA

5.1 Socio-cultural and economic characteristics of the project region

175. The PURE project aims at removing barriers for the dissemination of productive uses of energy generated by renewable energy technologies (RETs) in Guatemala's poorest areas, such as the departments of Alta Verapaz, Baja Verapaz, Quiché, Huehuetenango, and San Marcos. The population of this area is mainly of Maya origin, including the following ethnic groups: Q'anjob'al, Jakalteko, Chuj, Mam, Ixil, Q'eqchi', Poqomam, K'iche' and Kaqchikel, all of whose first language is one other than Spanish.
176. Participatory needs assessments conducted by Fundación Solar during 2000-2004 among 92 communities of this region revealed that the average daily income per family stands at 1 US dollar (US\$) per day or approximately 240 quetzals (Q) per month, placing the region under the extreme poverty line. The local economy is mainly based on agriculture with maize, beans and chili as the dominant crop for subsistence. Important cash crops are coffee, cardamom and banana.

5.2 Main characteristics of the selected project areas

177. Table 9 summarizes the main characteristics of the selected project areas.

Las Conchas

178. Chahal is an isolated municipality in Alta Verapaz and consists of various communities, including Las Conchas. Most families live in poverty in dwellings made from locally available materials. Main economic activity is cultivation of crops, such as maize, rice, beans and chilies. Apart from sale of crops, temporary workers provide additional income of around US\$ 5 a day during June-August. Average annual income is US\$ 2,700 approximately.
179. A family spends on average US\$ 7.60 per month on fuels, i.e., \$ 3.20 on kerosene, \$ 2.00 on candles and \$ 2.40 on torch batteries). Firewood is either collected (taking about 1 hour at 0.5 km average distance) or bought (between \$ 0.60-0.75 per load, lasting 1-3 days, and \$ 7.50 per *tarea* (task), a *tarea* defined as the amount a man can cut in a day, about 1.3 m³).
180. In terms of infrastructure, a communal water pump is available, but reportedly the system is sometimes dysfunctional for weeks (due to lack of capacity, maintenance problems and lack of fuel). Families are charged US\$ 2.50 per month for the water service. The community has no community centre, telephone center or health post, but has 1 small school. The community has one maize mill and 4 small shops.

Table 9 Socio-economic characteristics of the 4 case study project sites

| Project area | Las Conchas | Seasir | Jolom Ijix | Chel |
|---|--------------------------------|---|---|--------------------------|
| Communities | Balneario Las Conchas | Sasir, Chinasir | Jolom Ijix (6 communities) | Chel, Las Flores, Xexají |
| Municipality Region | Chahal Alta Verapaz | Cahabón Alta Verapaz | Panzós Alta Verapaz | Chajul Quiché |
| Number of inhabitants Number of households | 1,498 303 | 781 132 | 1,562 239 | 2,258 440 |
| Main indigenous language | Q'eqchi | Q'eqchi' | Q'eqchi' | |
| Income generating activities | Ecotourism; Shops. | Coffee, cardamom, wood products; Shops | Coffee and cardamom, Shops | Coffee; Shops |
| Other crops | Maize, rice, frijol, chili; | Maize, frijol, chili, cacao | Maize, frijol, chili, cacao, banana | Maize, frijol, chili |

181. In terms of village-level organizations, the most important are Community Development Council (COCODE), the Education Committee (COEDUCA) and the Women's Committee.
182. A tourist facility (*turicentro* with 5 small bungalows) is located near the Sepemech waterfall on the Chiyú River, referred to as Balneario Las Conchas. Tourists currently pay around US\$ 1 -4 for entry. In 2004, earnings were around \$ 7,500 with a net profit of \$ 2,000. Facilities include 5 bungalows (costing around \$ 10 per person with a 4-person capacity), one sanitary facility, camping sites and a small mini zoo. Almost 95% of visitors are Guatemalan nationals. The *turicentro* is currently owned by the Chahal municipality.

Seasir

183. The two communities of Seasir and Chinasir belong to the Cahabón municipality, also located in Alta Verapaz. The predominant ethnic group is Maya Q'eqchi'. Almost all of the cultivated lands are communally owned (95%). The villages can in general be characterized as extremely poor, basically depending on subsistence agriculture (maize, frijol, and chili) for their own consumption³⁶. Main cash crops include cardamom and coffee that are sold unprocessed to middlemen (*coyotes*) in the nearby town of Cahabón where the products are dried and processed³⁷.
184. Infrastructure is basic; the area has one primary school, 4 shops, 1 health post, 1 community centre and two gasoline-fuelled *nixtamal* (maize) mills. In 2001, 76 solar home systems were installed by Fundación Solar, but the majority is reportedly not functioning anymore due to lack of maintenance³⁸. A community water pump and latrines, were installed in 1977 and 2001, respectively, but are reportedly in bad condition.
185. A family spends an average of US\$ 7 per month on sources of light and power (candles, kerosene, torch batteries). Firewood is either gathered (done by men, taking about 3 hours) or bought, costing Q 15 (\$ 1.90) per load (which last 3 days) and Q 50 (\$ 6.30) per job (understood as the amount a man prepares in a day, about 1.3 m³).

³⁶ Additional income is provided by migrant labor during the months February -September a salaries of around Q 30 per day (\$ 3.80), much below of the official minimum wage of Q 47/day.

³⁷ Average crop production levels in Seasir are:

- Cardamom: 0.7 hectares (ha), 4 quintals/ha; 1 quintal = 45.5 kilograms
- Coffee: 0.26 ha, 2.5 quintals/ha
- Maize: 1.4 ha, 0.5 quintals/ha

³⁸ The USAID post-hurricane Match reconstruction Project, provided the funding for the PV Project in charge of Fundación Solar, CARE Guatemala was the institution in charge of follow-up to ensure PV operation in exchange of land protection, but CARE did not follow through.

186. The farmers in the village have not organized themselves as such, although various village-level organizations exist, such as the COCODE, COEDUCA and the Women's Committee³⁹. No access to credit facilities exists and households have to rely on neighbors or family for small loans.

Jolom Ijix

187. Six communities⁴⁰ have been formed out of what was previously the area of Finca Jolomijix. In general, the population can be characterized as poor or extremely poor. Most people belong to the Q'eqchi' ethnic group and 2% to the Poqomchi', while 3% is Spanish speaking. Main cultivation is maize, beans, chilies and vegetables. Main cash crops are cardamom, coffee and bananas. The average income per farming family is about \$ 2,108⁴¹. Productivity levels of the cultivated area is generally low; for example, the average area cultivated of maize is 2.8 hectares per person yielding an average 24 quintals per hectare; the average area of coffee cultivated is 0.24 hectares per coffee farmer producing 48.6 of coffee cherries (*café cereza*, which is equivalent to 7.78 quintals of processed coffee at *oro* quality).
188. Village-level organizations include COCODE, COEDUCA, Water Committee, the Women's Committee and other groups. The cardamom producers are organized in an association, APCOR. PRODEVER⁴² has donated 3 crop dryers for which purpose a cooperative was set up. A number of NGOs are active in Jolom Ijix working in the areas of poverty alleviation, health improvement, local institutional and rural development⁴³.

6. ELECTRICITY AND RENEWABLE ENERGY IN GUATEMALA

6.1 Electricity sector

189. In Guatemala, electricity production, transmission and distribution is based on free competition between private and public, national and internationally owned companies. Currently, around 53% of electricity is generated by private companies. The state still participates through EGEE⁴⁴ owning about 481 megawatts (of which 444 MW are hydroelectric plants), while the private sector owns about 1247 MW (mostly thermal plants. Total installed in 2005 was 1,728 MW, of which 38% hydropower, 50% thermal fossil fuel based plants, 11% cogeneration (in the sugarcane industry) and 1% geothermal. Energy production in 2005 totaled 7,220 GWh, of which 40% hydropower, 58% thermal and cogeneration and 2% geothermal.
190. Transmission in the national interconnected power grid in Guatemala is under the responsibility of the state-owned ETCEE. Electricity distribution is mainly in the hands of private companies, namely EEGSA (owned by the consortium Iberdrola-TPS-Elctricidad de Portugal), DEORSA and DEOCSA (both 80% owned by the Spanish company Unión Fenosa). The role of the state in distribution has now been reduced to 16 municipally owned distribution companies (of which four are involved in electricity generation as well).

³⁹ Water, solar energy and latrine committees have been formed, but with deficient activities as the hardware they are managing is not functioning

⁴⁰ San Vicente, Paraíso, Jolom Ijix III, Jolom Ijix IV, Chajomha, Monja Blanca and Canaan

⁴¹ Cardamom: US\$ 385; coffee: \$ 881, other cash crops: \$ 41; salaries: \$ 710 and remittances: \$ 91

⁴² *Programa de Desarrollo Rural de las Vera paces*

⁴³ Global Neighbors, CARE, PRODEVER, Defensores de la Naturaleza, Médicos del Mundo España, ECAM and CONTIERRA

⁴⁴ Both ETCEE (*Empresa de Transporte y Control de Energía*) and EGEE (*Empresa de Generación de Energía Eléctrica*) are subsidiaries of the state-owned INDE (*Instituto Nacional de Electrificación*)

Table 10 Examples of identified small-scale hydropower projects 1-8 MW

| Project | River/Basin | Capacity (MW) |
|------------------------------------|----------------------|---------------|
| Macahquilá (Petén) | Machaquilá | 1.0 |
| Nueve Palos (Quiché) | Quisayá | 1.0 |
| Lankin | Cahabon | 1.0 |
| Turingia | Nahualate | 1.2 |
| San José La Arada (Chiquimula) | San José | 1.5 |
| El Injerto | El Enjerto/Selegua | 1.5 |
| Uspantán (Quiché) | El Calva río | 2.0 |
| Quizaya | Polochic | 2.0 |
| Rio Polochic | Polochic | 2.0 |
| El Salto y Marinala | Maria Linda | 2.2 |
| Clavellinas (Quiché) | Las Cataratas y Azul | 2.4 |
| Las Cataratas | Xacibal | 2.4 |
| La Cíntal | Ocosito | 3.0 |
| Mesquite | Samala | 3.5 |
| Saltan (Guatemala) | Saltan | 3.6 |
| La Pólvora (Petén) | Mopán | 4.0 |
| San Sebastián (Huehuetenango) | Esquisal | 4.0 |
| Vinam (Quiché) | Moxolá y Cotzal | 4.0 |
| Chichicastenango (Quiché) | Motagua | 4.8 |
| Xoxlac (Huehuetenango) | Xoxlac | 5.0 |
| San Antonio Huista (Huehuetenango) | Ocho | 5.0 |
| El Lobo (Zacapa) | El Loboa | 5.0 |
| Los Amates | Los Esclavos | 5.0 |
| Maza | Nahualate | 5.0 |
| Boca Nueva (Alta Verapaz) | Boca Nueva | 6.0 |
| Jupilingo (Chiquimula) | Jupilingo y Copán | 6.0 |
| San Francisco Cotzal | Salinas | 6.0 |
| Sala | Suchiate | 6.0 |
| Cotzal | Salinas | 6.5 |
| San Isidro | Salinas | 7.0 |
| Tinajas (Alta Verapaz) | Tenajas | 7.0 |
| Bethania de la Sierra | Zarco/Polochic | 7.2 |
| Rio Seco (Huehuetenango) | Seco | 8.0 |

Source: *Invierta en Recursos Renovables* (MEM, 2006)

191. The legal framework for the power market is given by the General Electricity Law (1996) and regulations and standards derived from the Law. The Ministry of Energy and Mines (MEM) is responsible for formulating and coordinating policy and planning regarding the power sector and for applying the General Electricity Law and its regulations. The National Electric Energy Commission is the technical arm of MEM, responsible for executing the legislation, defining tariffs for transmission and distribution, arbitrage between power sector agents and defining technical norms and standards. Another technical body, namely the AMM⁴⁵, oversees sales of electric power and energy.
192. In 2005, the electrification rate was 84%. It should be noted that the departments on which the PURE project focuses have the lowest electrification rates in Guatemala, e.g. Alta Verapaz 44%, Baja Verapaz 68% and Quiché 70%. Current grid coverage in the PURE target areas (the five departments of Alta Verapaz, Baja Verapaz, San Marcos, Huehuetenango and Quiché) is about 71%, but coverage in rural areas only amounts to 50%.

6.2 Renewable energy

⁴⁵ CNEE: *Comisión Nacional de Energía Eléctrica*; AMM: *Administrador del Mercado Mayorista*

193. Guatemala has a hydroelectric potential of 10,000 MW, of which as much as 5,000 MW may be developed as small-scale hydro projects with minimal environmental impacts⁴⁶. The country is currently using only 11% of this potential. Guatemala has a geothermal potential of 1,000 MW, of which it is using only 3%. Wind energy resources amount to about 8,000 MW of which no development has been made. Solar resources are abundant, with a 5.3 kWh per square meter/day average radiation.
194. A number of NGOs realize energy projects in Guatemala, such as Fundación Solar and NRECA Ltd., basically focusing on rural and renewable energy and often working with international aid organizations, such as multilateral (UNDP, GEF), bilateral (European Union, USAID) and private organizations (Winrock).
195. The new Law for Incentives for the Development of Generation from Renewable Energy Sources (2003) will help level the playing field with thermal generation using fossil fuels by providing fiscal and economic incentives to investors in renewable energy. By December 2005, some 9 projects had benefited from the new Law with a total capacity of 174 MW (of which 3 hydropower, 3 biomass and geothermal projects).
196. Regarding mini and micro hydropower, a number of potential micro hydropower project opportunities have been identified by INDE, Fundación Solar and NRECA as given in Table 10.

7. MARKET ASSESSMENT PRODUCTIVE USES OF ENERGY

7.1 Introduction

197. Guatemala's Government has developed a poverty reduction strategy that identified a geographical poverty belt corresponding to the departments where the proposed PURE Guatemala project will be implemented. In this strategy, the Government established a new rural development policy in response to the weakening situation of small farmers, faced with increased international competition. Poverty alleviation, improved management of land and water resources and control of pollution from agricultural sources are stated as immediate rural priorities. It recognizes that, instead of large-scale commodity production, Guatemala's highland agriculture should focus on quality products for export. A system of certification of origin of agricultural and food products is under development by three key organizations, the non-traditional product exporters (*Asociación Gremial de Exportadores de Productos No Tradicionales*, AGEXPORT), rural entrepreneurs (*Asociación Gremial del Empresariado Rural*, AGER) and the Rainforest Alliance (with support from USAID). The Government is pursuing full compliance with international pesticide legislation and starting to promote organic agriculture.
198. Traditionally, products like coffee, cardamom and timber are extracted from the field and sold unprocessed, because there is no infrastructure, electricity or managerial capacity to start such a value added chain of production. Unlike some other cash crops (such as fruits) energy inputs are essential to be able to process coffee and cardamom, by means of de-pulping, drying and packaging. Such processing creates local value added (e.g., more is paid for the processed coffee than for the freshly picked coffee cherry) and increases local employment. Conventionally, fossil fuels (diesel, gasoline, kerosene) can be used as energy fuel to run dryers, pumps, lighting or packing machinery. Alternatively, electricity generated by small-scale hydropower can be used, hereby displacing the diesel engines. Firewood is heavily used in drying of coffee and cardamom. The use of firewood can be reduced by increasing the efficiency in biomass use for drying through process improvements and/or by using solar thermal drying.

⁴⁶ *Energía en Guatemala* (the electricity wholesale market manager in Guatemala), prepared for the National Secretariat on Strategic Analysis of the Government of Guatemala (by Iván Azurdia Bravo, 2004)

199. Income can further be generated by promoting small-scale tourism sector. Most of the project portfolio opportunities are allocated in landscapes that can be developed as ecotourism facilities due to the presence of natural forests, protected areas, waterfalls, endemic species, etc. The availability of electricity powered by renewable energy technologies contributes to the development of small eco-resorts and cottage industry associated, with the use of refrigeration, lighting, cooking, communication, steam baths, research facilities and equipment, and the like.
200. Technologies that currently do not or hardly exist at the community level, such as lighting, refrigerators, electric sewing machines and other appliances, will appear once electricity is available, thus improving quantity and productivity of:
 - *Productive uses*, such as handicrafts (wood crafts, ceramics, baskets, clothing) and local market products and services (repair shops, restaurants and small stores)
 - *Social uses*, such as domestic lighting and water supply for households and services (schools, clinics, community centers).

7.2 Organic and fair trade coffee

Coffee production and commercialization in Guatemala

201. Coffee represents an important cash crop in Guatemala. In 2004-2005, some 204 million kilos of coffee were produced, of which 94% was exported to the main markets in the United States, Europe and Japan. According to FAO projections, coffee production in Guatemala is expected to increase to around 350 million kilos in 2010. Two main types of coffee are produced internationally, namely 'robusta' and 'arabica' coffee with the latter group being divided in 'colombian mild', 'brazilian mild' and 'other arabica'. Central American countries predominantly produce the 'other mild arabica' variety.
202. In general, the international market price of coffee has not only proven to be quite volatile, but also shows a downward trend. Over the period 1976-2005, the international coffee price varied widely between USD 235 and USD 60 per quintal⁴⁷ but showed a general downward trend from \$ 175 to \$ 80 per quintal. In general, the prices paid to producers in Guatemala followed this trend (see figure 2). At the time of performing this case study on coffee production, the price was about US\$ 110 per quintal

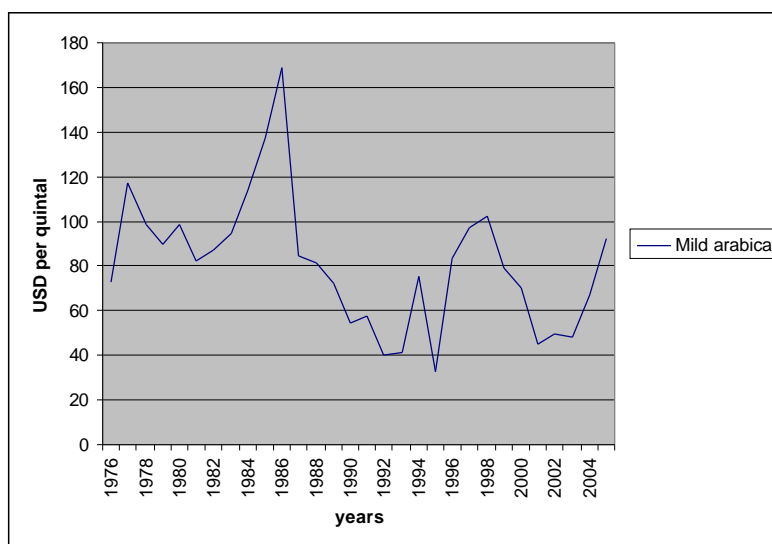


Figure 2 Evolution of coffee prices in Guatemala

⁴⁷

1 quintal = 45.5 kg

(April 2006).

203. Coffee beans are the seeds of fruits which resemble cherries. Each cherry generally contains two coffee beans. Coffee beans must be removed from the fruit and dried before they can be roasted; this can be done in two ways, known as the dry and the wet methods. In Guatemala, the wet process is used (*beneficio húmedo*). After sorting and cleaning, the pulp of the fruit is separated from the beans by mechanical means in a pulping machine. The pulped beans then go into large fermentation tanks for some 1-1.5 days to completely remove some remaining residual flesh and the sticky mucilage adhering to the parchment surrounding the beans. After fermentation, the coffee is thoroughly washed. To reduce the moisture content of the coffee from 57% to up to 12.5% the coffee needs to be dried, either in the sun, in a dryer, or a combination of the two. Sun-drying is done on flat concrete or brick areas (*patios*), taking some 8-10 days. The use of hot-air drying speeds up this drying process (which firewood is used to heat the air and ventilators to move the hot air around). After drying, the wet-process coffee is stored, known as parchment coffee (*café pergamino*). About 5 quintals (=45.5 kg) of coffee cherries (*cereza*) yield one quintal of processed beans (*pergamino*). Beans can be sorted and further processed by removing outer membranes to achieve gold quality; thus, 1.25 quintals of *pergamino* give 1 quintal of coffee *oro*.
204. There are some 65,000 coffee producers in Guatemala, most of them working on an individual farms that vary from large, medium and small in size. Small producers have less than 3 hectares and produce less than 40 quintals of coffee *oro* equivalent. Generally, most of the small producers sell the raw coffee beans (*cereza* or *maduro*) to intermediaries (in Guatemala referred to as *coyotes*)⁴⁸ or, if the small producers are organized, to cooperatives, sometimes directly to the coffee processors. The intermediaries act not only as transporters, but often provide credit as well, but at high interest rates⁴⁹. Another problem that transportation of the coffee cherries can take up to 2 days, during which part of the coffee starts fermenting, losing quality. The medium-sized and large producers usually process and dry the coffee beans themselves to get *pergamino* quality and have their own transport facilities to get the product to the commercial processors or even straight to the exporters. There are some 650 licensed coffee exporters in Guatemala.
205. In Guatemala, ANACAFE is the national organization responsible for regulation the coffee sector in Guatemala. By law, all coffee producers belong to ANACAFE and the organization is also in charge of issuing export permits to producers or traders. Both ANACAFE and the Ministry of Agriculture (MAGA) have set up trust funds to support small coffee farmers.
206. Apart from ANACAFE, the coffee growers are voluntarily organized in a number of organizations, such as associations, cooperatives and federations that represent their interests. Most medium-sized and large coffee growers and exporters are organized in associations, such as PROCAFE, ACOGUA, CARCOR, AEC, ACU⁵⁰, etc. These associations themselves are represented in ANACAFE as well.
207. The cooperatives form an interesting alternative for small coffee farmers. Through the cooperatives (and one of the federations a cooperative usually belongs to)⁵¹ the small grower has access to cheaper credit to finance the inputs needed for their coffee harvest. Also, some cooperatives have sufficient economics of scale to be able to process the coffee locally, giving a value added to the product, and even market the product directly to exporters (thus eliminating the need for *coyotes*). Not all cooperatives have been that successful; their relative high cost of administration and lack of access to

⁴⁸ One or more intermediaries (local, regional) can be involved

⁴⁹ At high interest rates of 36 -60% (on an annual basis) as compared with the bank interest rates of 17 -22%

⁵⁰ ANACAFE: *Asociación Nacional del Café*, PROCAFE: *Asociación de Productores Exportadores de Café*, ACOGUA: *Asociación de Caficultores de Oriente de Guatemala*, CARCOR: *Coordinadora de Asociaciones Regionales de Caficultores Organizados de la República*, AEC: *Asociación Experimental Cafetalera*; ACU: *Asociación de Caficultores Unidos*

⁵¹ For example, FEDECOCAGUA (*Federación de Cooperativas Agrícolas de Productores de Café de Guatemala*) was established in 1971 as a federation of coffee growers' cooperatives that exports coffee directly. FEDECOVERA (*Federación de Cooperativas de las Verapaces*) was set up in 1979 as a federation of 32 agricultural cooperatives in the Baja and Alta Verapaz regions and is involved in the cultivation of coffee and cardamom. A third organization is UCONOFEC (*Unión de Cooperativas No Federadas de Café en Guatemala*), founded in 1983, but unlike the other Federations is not involved in coffee commercialization, but focuses on providing technical assistance

sufficient sources of finance for their members imply sometimes that in the end they are not always able to offer a better price than the commercial intermediary.

Coffee pricing and market for premium coffees

208. Other cooperatives have managed to get a better profit for their members by exporting the processed coffee directly, e.g., into the *'fair trade'* market niche⁵². In this market niche, various NGOs provide the *'fair trade'* label if the coffee is cultivated by cooperatives that meet certain socio-economic criteria. Max Havelaar was the first to introduce coffee in the Netherlands in 1988 and since then a number of other initiatives have been established in Europe and other parts of the world, such as TransFair and Fairtrade Mark. Another step was taken when the commercial coffee company Starbucks decided to sell fair trade coffee in 2000. A second alternative for small farmers to obtain more profit is the cultivation of *'organic coffee'*, i.e., without using chemical fertilizers or pesticides. As with fair trade, customers in Europe and USA are ready to pay extra for organic coffee.
209. For example, the price paid for Guatemala coffee varied from US\$ 93.5, 58.7, 57.9, 59.8, 73.0 to 104.2 in 1990/00, 2000/01, 2001/02, 2003/04 and 2004/05 respectively. In contrast, the international Fair Labeling Organization (FLO) guaranteed in 2001 a minimum price of US\$ 126 per quintal for wet-processed arabica coffee from Central America and \$ 141 for organically grown wet-processed arabica (\$ 120 and \$ 135 for dry-processed coffee respectively). In general, the prices of the organic coffee on the international market have not only been higher, up to \$ 15 per quintal, but also the prices of both fair trade and organic coffee tends to be more stable as minimum prices are guaranteed by the international NGO that market these coffee alternatives. It should be noted that Fair Trade/Organic certification not only pays a *premium on price*, but that it also *pays in advance* to farmers, thus mitigating the "poverty trap" by providing working capital in advance to coffee markets. This implies that the expensive role of *coyotes* in credit supply, as mentioned before, can be avoided.
210. Production of *'value added'* coffee requires both better agricultural practices in production, in marketing of the produce as well as in modern energy inputs for improved processing (de-pulping, drying, and packaging). In general, a number of energy and non-energy barriers inhibit the realization of improved coffee production, processing and marketing by small farmers:
- *Agricultural production.* Cultivation of coffee and crops in general is done in a traditional way using few inputs, such as pesticides. This should not be confused with modern organic cultivation, characterized by the use of carefully chosen seeds, supply of nutrients and water to the growing plant and by control of diseases and other activities in order to increase the production per unit of area.
 - *Lack of processing facilities.* The communities do not have adequate processing facilities for de-pulping and drying. One reason is the *lack of affordable credit* to enable them to make investments. Another reason is *lack of energy* to power machinery in the remote coffee producing areas that are not connected to the grid.
 - *Land degradation.* Over-exploitation of natural resources (e.g., clearing land) in the area lowers the ability of the soil to capture and distribute rain water.
 - The general *low education level* and occurrence of *analphabetism* amongst the farming households as well as the *lack of organization* into producer cooperatives or associations limits them in implementing improvements in their cultivation, in making business-like decisions on small investments and marketing of products. Consequently, this leaves them vulnerable to the conditions posed by intermediary traders who set the price of coffee and provide credit at elevated interest rates.
 - In some cases, *land titles* are not clearly defined and/or legalized and this stops farmers from making investments in the lands they cultivate.

⁵² In 21/04/2006 the average price paid to coffee producers paid in Guatemala was \$ 98.78 (coffee o ro), the price f.o.b. was \$ 111.40 and the corresponding price on the market in New York (NYBOT) was \$ 114.40

211. The PURE in Guatemala Project will not only address the barriers to the introduction of modern energy carriers, but will simultaneously address the barriers to the productive use of energy by implementing sustainable business plans for the development of productive uses (coffee, in this case) and for renewable energy (micro hydropower) in an integrated way. In this setup, GEF funds will be used to address the energy barriers, while co-funding from the Ministry of Agriculture (MAGA) and other donors will be used to address the non-energy barriers, by working together with coffee organizations such as ANACAFE, rural development banks and coffee growers' associations.

Description of the proposed coffee processing in the area of Jolom Ijix

212. In Jolom Ijix, coffee is produced by small farmers that sell the fresh product to the nearby processing facility, where it is de-pulped and dried to get parchment quality coffee (*pergamino*). The average production is about 535 quintals of *pergamino*, based on the average production of 9.7 quintals per hectare by the 239 coffee farming households. Coffee production starts in September/October to January/February with a peak period during October/November. In the Jolom Ijix area the coffee *cereza* is transformed into coffee *pergamino* in nearby individual wet-processing facilities. Although the coffee fields may not be more than 2 km away from the processing facilities, access to the individual plots is difficult and transportation cost (by intermediaries) are reportedly high, about US\$ 1 per quintal of fresh product transported.
213. Coffee is produced traditionally, characterized by not using pesticides and minimal land preparation. With support from the MAGA, the PURE project will include a number of measures to promoting of the value-added production of coffee:
- *Organization of producers* in a local associations and *capacity building* of their members means of participatory processes on productivity improvements in agriculture, orientation towards value-added processing of cash crops, such as coffee and cardamom and the benefits of income generation
 - Identification and establishing marketing *links with the local and external markets*, especially in the area of organic and fair trade coffee.
 - Support the villagers in petitioning local authorities to improve the *infrastructure*, currently existing of small paths to their agricultural plots to have better access to the area and to have better health and education facilities
 - *Improved coffee cultivation productivity* by means of promoting the application of organic fertilizer, disease control, weeding and other practices.
214. In the Jolom Ijix area San Vicente a communal coffee processing plant was established by the NGOs Capi/Movimundo, Forestrade and the Social Investment Fund (FIS) in the San Vicente community with a capacity of 160 quintals of coffee *cereza* per day (or 12,800 quintals a year). The plant was built to accommodate the production not only of San Vicente, but of other villages in the Jolom Ijix and neighboring area. The plant also has a storage facility for 2,000 quintals of *pergamino* coffee. With the Jolom Ijix area only producing 536 quintals of coffee (*pergamino* quality), the plant is clearly underutilized and not economic. In the PURE project therefore will aim at achieving economics of scale by (1) promoting the centralization of coffee processing in the enhanced San Vicente facility, thus replacing the even less economic individual plants in the area, and by (2) promoting productivity increase in the coffee production. Average production per hectare in Jolom Ijix is low, about 7.8 quintals *pergamino* in 2003, in comparison with the average production of Alta Verapaz in 2003/04, 13.2 quintals and the average for Guatemala as a whole in 2003/04, namely 15.1 quintals per hectare.
215. In the PURE project, the diesel fuel currently consumed in coffee processing will be replaced by electricity generated by the proposed micro hydropower (MHP) plant (described in paragraph 5. 2), either by replacing some disperse diesel generation sets of the individual plants and/or by concentrating the de-pulped and drying process at an enhanced facility, replacing the alternative diesel engines as well. The cost of transportation of coffee beans (to the centralized facility) would increase, maybe \$ 1 per quintal, but this would be offset by the reduced cost of energy inputs, as indicated in Table 11.

216. Table 11 shows savings of US\$ 1.18 per quintal due to the use of electricity from MHP instead of diesel engines. Assuming that the full processing capacity would be used (12,800) this would imply savings of USD 9,800 per year.
217. Production cost of coffee cherries (*maduro*) is an estimated US\$ 57 per quintal of processed coffee (*pergamino*), which itself fetched a price of US\$ 79 (April 2006). Subtracting the cost of processing the coffee (as given in Table 11), this implies a profit of \$ 12 per quintal (18%) for diesel-fueled processing and of \$ 13.20 (20%) for MHP-powered processing respectively.

7.3 Certified wood products

Wood production in Guatemala

218. Guatemala produces wood and wood products from pine, cypress and mahogany trees for home construction, and furniture and construction industry in the national market. In the provinces of El Petén and Zacapa, prices of wood sold to the wood processing plants vary between US\$ 24-38 m³, depending on the tree species and location. Wood product providers vary from forestry and wood processing companies, intermediaries to individuals or community-level companies. Producers market their products directly with the national or international buyers.
219. Exports of wood and wood products from Guatemala had a value of US\$ 51 million in 2003, of which about 50% to the USA and 34% to Central America (of which half to El Salvador) and the Caribbean. National demand is over 500,000 m³ mostly used in the construction and furniture industry. Wood is even imported from other Latin America countries; the parquet industry, for example, imported some 5,000 m³ of hardwood during 2003-2005. Reasons for importation are quality and pricing of the wood

Table 11 Cost comparison of energy inputs in the wet-processing of coffee (diesel versus electricity from a micro hydropower plant)

| | Internal combustion engines | | | | Electric motor | | | |
|---|-----------------------------|--------------|------------|--------------|----------------|--------------|------------|--------------|
| | Unit | No. of units | Unit value | Total (US\$) | Unit | No. of units | Unit value | Total (US\$) |
| Salaries | | | | 2.30 | | | | 2.30 |
| 1. Receiving and weighing coffee cherries | Day | 0.0350 | 5.34 | 0.19 | Day | 0.0350 | 5.34 | 0.19 |
| 2. De-pulping | Day | 0.1000 | 5.34 | 0.53 | Day | 0.1000 | 5.34 | 0.53 |
| 3. Washing | Day | 0.0650 | 5.34 | 0.35 | Day | 0.0650 | 5.34 | 0.35 |
| 4. Sun drying (<i>patios</i>) | Day | 0.1650 | 5.34 | 0.88 | Day | 0.1650 | 5.34 | 0.88 |
| 5. Storage | Day | 0.065 | 5.34 | 0.35 | Day | 0.065 | 5.34 | 0.35 |
| Other wage benefits | | | | 1.76 | | | | 1.76 |
| Inputs | | | | 2.70 | | | | 2.24 |
| Diesel fuel | Gallons | 0.83 | 3.27 | 2.70 | | | | |
| Electric energy | Kwh | | | | Kwh | 11 | 0.20 | 2.24 |
| Depreciation and operation | | | | 3.22 | | | | 2.49 |
| Diesel engine | Year | 1 | 0.72 | 0.72 | Year | 1 | | |
| Infrastructure and equipment | Year | 1 | 1.59 | 1.59 | Year | 1 | 1.59 | 1.59 |
| Operation and maintenance | Year | 1 | 0.91 | 0.91 | Year | 1 | 0.91 | 0.91 |
| Total cost per quintal (coffee <i>pergamino</i>) | | | | 9.97 | | | | 8.78 |

Source: own calculations, based on the data provided in Fundación Solar (2006a)

An exchange rate of USD = Q 7.9 has been used in the calculations.

Assumptions: Investment cost in processing a drying facility of 1,000 quintals of *pergamino* quality is US\$ 12,075, lifetime: 15 years, discount rate: 10%, giving an annualized investment cost of US\$ 1,588 or \$ 1.59 per quintal.

Energy assumptions: Investment cost in a 9 kW diesel engine is US\$ 2,750 with a 10-year lifetime and operation and maintenance cost of 10% of investment cost; fuel consumption at 2.5 liters per hour at US\$ 0.86 per liter.

The alternative is provided by hydropower electricity at US\$ 0.20/kWh (the tariff assumed for productive use of hydropower assumed in this study). It should be noted that this tariff is below the real total cost of production of energy of the hydropower plant (but in line with actual non-social tariff of the power grid). If the real cost (about US\$ 0.3/kWh, see Table 9) would be used, the total cost per quintal of processed coffee of using a MHP-driven electric motor would increase to US\$ 9.90, still somewhat below the cost of employing diesel engines!

and reliability and punctuality in wood supply.

220. The forest cover in Guatemala was about 4.29 million hectares in 2002 (about 39% of the national territory), out of which some 56% are located within protected areas, such as the Maya Biosphere Reserve.

Market for certified wood products

221. Certified timber products are sustainably produced in Guatemala, but the domestic market for certified products is almost non-existent and all certified wood is exported. Production of certified wood takes place in the El Petén region by 10 community-based⁵³ organizations (associations and cooperatives) and two commercial companies within the framework of local forestry management plans to ensure that the wood is sustainably produced. Some 13,300 m³ was produced during 1999-2005 and exported. Currently, only Smartwood (of the Rainforest Alliance), accredited to the Forest Stewardship Council, certifies wood in El Petén. Some 518,000 hectares have been certified in Guatemala, of which 380,000 ha of community forestry area, while certification of some 31,000-69,000 ha is in progress.
222. A number of energy and non-energy barriers limit the development of the market for certified wood products, which are summarized below with possible options to lower the barriers:
- The bureaucracy involved in certification is quite costly and has up to now been covered by donor organizations, such as USAID. Certification costs about \$ 10,000 per company (every 5 years) with annual auditing cost of \$ 3,000;
 - Communities could reduce this cost by grouping together.
 - The market for certified products from Guatemala is still very nascent and currently the price offered for certified products does not differ much from the conventional wood products prices;
 - The demand for certified products in Europe and USA is slowly but steadily growing and as the market grows a similar priced difference will occur as is the case with premium coffee. A recent study by Ozanne and Winterhalter showed that 40-60% of consumers would be willing to pay 12-25% more for certified wood products.
 - The capacity of communities to offer value added products is limited, because they lack knowledge about commercialization (communities sell wood to buyers that visit them, not the other way around) and because they lack wood processing plants that have a sawmill and wood drying facilities;
 - This barrier can be limited if communities have wood processing equipment by having access to credit facilities and *modern sources of energy*, such as electricity
 - Capacity building such as carpentry skill development, wood product marketing and sustainable forest management.

Description of proposed wood production and processing in Seasir

223. Already some certified wood production has been implemented in the El Petén area. While the area, in which Seasir is located, has potentially high potential for forestry production, it cannot be compared with the El Petén forests with its high-value tree species, such as mahogany. The market analysis of Seasir (as the area chosen for the wood products case study) concludes therefore that the potential for production by sustainable natural forest management, such as in El Petén, is low and suggests instead the establishment of plantations with fast-growing species dedicated to the production of certified wood, also given the fact also that cheap manual labor is readily available in the area. Most of the agricultural area in Seasir is communally owned (although cultivated individually) and this holds for the forest as well.
224. Currently, the forest is only used to extract firewood. Using forest for more commercial purposes will require a cultural change in how the community looks at the forest, although almost 80% of the people interviewed during the market assessment were aware of the existence of the Forest Incentives

⁵³ The communities created FORESCOM (*Empresa Forestal Comunitaria de Servicios del Bosque*) in 2003. During 2003/2004, FORESCOM commercialized 167 m³ of non certified wood (at a value of USD 87,340) and 42 m³ of certified wood (USD 24,120)

Program (PINFOR) in Guatemala. Under PINFOR, financial incentives are given for reforestation efforts.

225. The case study (focusing on the Seasir area) carried out by Ecodesa for Fundación Solar suggests in *the short term* to establish an association of participating community members⁵⁴. The association would manage a wood plantation that produces timber and firewood⁵⁵ and, *in the longer run*, would establish a saw mill to produce ‘value adding’ wood products.
226. Assuming that 77% of the households (i.e., 88 families) would participate in the Association and each family would correspond 0.6 hectares, this implies that the Association would start with reforesting 53 hectares (ha), which would be ‘rented’ from the community:
- *Costs* will consist of the rent (US\$ 73 per hectare per year), planting the trees (every five years) and nursing them with associated labor costs;
 - *Benefits* would derive from the sale of firewood and wood poles (after 6 years), seeds (after 9 years) and timber (after 13 years) as well as of reforestation incentives provided by PINFOR⁵⁶ (during the first 5 years).
 - The *cost-benefit analysis* of the market study shows an average annual cost of US\$ 23,500, average annual benefits of US\$ 38,500 and a net present value of \$ 9,800 (over 25 years, at a 12% discount rate). The investment support from PINFOR would be around \$ 80,000 in total during the first six years. Given the fact that there is considerable time gap between investment and revenue (as trees need to grow), PINFOR’s support is important by ensuring some cash flow already in the beginning of the activity and by meeting large part of the *initial financing* needed, an estimated US\$ 100,000.
227. Of course, profitability would depend on to whom and by whom the wood is sold; wood can fetch between USD 6.2 and USD 48 per m³, depending on who (individual producer or commercial forestry company) and how the wood is sold and depending on the wood species. Getting a good price for the wood products implies identification of proper marketing channels to access the national and international markets, in particular the certified wood market. For this purpose, the Association would register its woodlot with INAB (necessary anyway to acquire PINFOR support) and with certification organizations, such as organizations accredited to the Forest Steward Council (FSC)⁵⁷ or to the ISO 14000 standard that covers eco-labeling.
228. In the longer term, as the forest plantation matures, the establishment of a saw mill is planned. This will be provide value added to organized small-scale producers (such as the Association) who sell wood at USD 6.2-10 per m³, but can sell sawn wood at double the price or even at USD 40/m³ if processed into boards or planks. Establishing a saw mill would imply the having *access to electricity* to drive the saws, drills and other machinery, to be provided by the proposed micro hydropower plant in Seasir. No cost-benefit analysis has been made yet of such a wood processing plant. In general, one can say that the energy component in the annual costs of a sawmill is quite high, about 20 -25%, even up to 50% when taking into account the cost of wood preparation (drying, etc.). The profitability of the saw mill will therefore be highly dependent on the cost of the energy input. As discussed in paragraph 5.2, it will be more cost-effective to use electricity from a local micro hydropower facility rather than of a mini-grid powered by a diesel generator, let alone by individual diesel engines.
229. Given the fact that currently the communities are not involved in commercial forestry activities, a community forestry company or association would need *capacity building* support on company

⁵⁴ In the first 6-10 years institutional partners, such as Fundación Solar, could be member of the Directive Board, until local management capacity has been sufficiently developed. The Association will have a General Assembly of active associates as the overall decision-making body, a Directive Board, a Manager and staff (administrative, technical, day laborers) and be subject to external auditing.

⁵⁵ Currently, the community consumes about 3,175 m³ per year (or 27 m³ per family)

⁵⁶ The Forest Institute (INAB, *Instituto Nacional del Bosque*) is an autonomous entity, whose board of directors is coordinated by the Ministry of Agriculture, Livestock and Food (MAGA). INAB manages the PINFOR (*Programa de Incentivos Forestales*) program which provides incentives for reforestation and forest management. Some 18,000 ha were reforested between 1998 and 2001 with the help of PINFOR.

⁵⁷ Such as SGS Forestry, SCS, Rainforest Alliance, Soil Association

management and administration, reforestation and forest management, organic silviculture and environmental issues, wood processing, planning and marketing of wood and wood products as well as on credit and financial issues. The proposed PURE in Guatemala Project not only addresses the barriers to the introduction of modern energy carriers, but will simultaneously address the barriers to the productive use of energy by implementing sustainable business plans for the development of sustainable wood production and processing and for renewable energy (micro hydropower) in an integrated way. In this setup, GEF funds will be used to address the energy barriers, while co-funding from the Ministry of Agriculture (MAGA) and/or other donors will be used to address the non-energy barriers.

7.4 Cardamom

Market for cardamom

230. The main international markets for the cardamom spice are the Middle East, India, Europe and the United States. Guatemala is the main producer in the world (60%), followed by India (30%). Saudi Arabia is the main consumer (4,000-5,000 tons annually) and its supply comes mainly from Guatemala (80%). All production in Guatemala is exported. Over the past decades, cardamom exports from Guatemala have slowly but steadily gone up from 5,000 tons in 1981 to 30,000 tons in 2003 and 32,000 tons in 2005. About 70% of the production comes from the Alta Verapaz region.
231. Unlike coffee, there is no exchange or international organization that permits price setting of cardamom internationally. Prices are directly negotiated between exporter and importer. There has been a tendency however for the price to go down over the past decades as more exporters have appeared on the market (notably India); average price was US\$ 10 per kg between 1980 and 1986 compared with \$ 3.5 per kg during 1989-1995 and with US\$ 3.1 during 1996-2000.
232. In Guatemala, the exporters (some 20) are organized in the CARDEGUA association⁵⁸. The producing farmers are not organized and negotiate their price with the exporters directly or through intermediaries (that buy cardamom from the small producers and transport to the exporters).
233. Similar to the organic coffee cultivation, there is a small market in the USA and Europe for organically grown cardamom that offers up to 35% margin above the price of the conventionally grown spice. According to AGEXPORT, currently five companies export organic cardamom⁵⁹. Mayacert is an organization, accredited in both the USA and Europe, which certifies the organic production of cardamom and coffee in Guatemala.

Description of potential cardamom processing in Seasir area

234. A number of non-energy and energy barriers inhibit the further development of the cash economy in the project areas, based on cardamom cultivation:
- *Agricultural production.* Cultivation of cash crops, such as cardamom and coffee, is done in a traditional way without applying modern knowledge on using inputs such as fertilizer and disease control (whether organic or chemical).
 - *Processing of products.* Currently, no processing is done and the raw product is sold to intermediary buyers (*coyotes*) that take the cardamom to a nearby center where the spice is dried.
 - *Lack of electricity* inhibits the use of modern communication media (telephone, radio/TV) as well as of productive machinery (although some households have been using solar PV)
 - *Education level* is low (only 50% has finished primary school, while analphabetism in reality hovers around 80%)
 - *Organization level* is low; often there is no producers' organization and each farmer negotiates with the intermediary traders (*coyotes*) on his own.

⁵⁸ CARDEGUA: *Asociación de Cardamomeros de Guatemala*

⁵⁹ Forestrade, ADEEC, Finca Doña Rosalía and ASIPOI

235. Production in Seasir-Chinasir was 1,070 quintals⁶⁰ of cardamom in 2004/05. Five quintals of harvested cardamom (*cereza*) yield about 1 quintal of dried cardamom, thus in terms of processed cardamom (*pergamino*)⁶¹ the production of was 270 quintals during 2003/04. Harvesting mainly takes place during August-January, but 75% of the harvest is collected in September-November. Cardamom is produced by the small farmers that sell the fresh product to intermediaries who deliver the cardamom fruits to processing facilities in nearby towns (such as Cahabón at 25 km distance).
236. More 'value added' for the village economy can be obtained by local processing of the cardamom fruits. The cardamom case study analyzed the feasibility of establishing a cardamom processing facility for the villages of Seasir-Chinasir. Such a small processing plant could be managed by the local producers' association APCOR⁶²
237. Cardamom processing requires investment in drying and storage facilities. The drying equipment needs ventilators that can be powered by a diesel engine or electric motors. For heating the air wood is used, which can be partly replaced if solar thermal drying technology is employed. Box 3 presents the case of a cardamom dryer with a standard 40 quintals a day capacity. It is assumed that the annual output is 1,000 quintals of cardamom *pergamino*. In this case, the profit of processing cardamom from freshly harvested into dried *pergamino* quality is 23.6% or US\$ 4.8 per quintal. Replacing the diesel engine with electricity from a micro hydropower plant (at a tariff of US\$ 0.20/kWh) would be advantageous and raise profitability to 25.0%.

⁶⁰ 1 quintal = 45.5 kg

⁶¹ Similar to coffee, 1.25 quintal of cardamom *pergamino* yields 1 quintal of *oro* quality

⁶² *Asociación de Productores de Cardamomo Orgánico Raxcam*

Box 3 Cost estimates of drying and processing organic cardamom

The table below describes the cost and benefits of converting 40 quintals of fresh cardamom (*cerezo*) by means of drying and selecting into 8 quintals of parchment cardamom (*pergamino*). Assumptions are that 5,000 quintals of parchment *cerezo* are processed annually in the dryer which has a standard output of 40 quintals of *pergamino* a day (5 quintals of cardamom *pergamino* yield 1 quintal of *pergamino*). Investment cost in the facility (dryer and storage) is about US\$ 12,000 and depreciation is US\$ 1588 (at a 10% discount rate and economic lifetime of 15 years). Annual operating costs are 7.5% of the investment cost.

Energy inputs: wood and diesel

| Concept | Units | Quantity | Unit price (US\$) | Value (US\$) | Percentage |
|---|----------|----------|-------------------|--------------|------------|
| Indirect costs | | | | | |
| <i>Inputs</i> | | | | | |
| Wood | m3 | 5 | 5.03 | 25.16 | 15% |
| Diesel | gallons | 7 | 3.27 | 21.60 | 13% |
| Electricity | kWh | 0 | 0.20 | - | 0% |
| Sacks | unidades | 10 | 0.63 | 6.29 | 4% |
| | | | | 53.05 | |
| <i>Labour</i> | | | | | |
| Pickers | task | 1 | 18.87 | 18.87 | 11% |
| Helper | task | 1 | 12.58 | 12.58 | 8% |
| Additives | quintals | 8 | 1.26 | 10.06 | 6% |
| | | | | 41.51 | |
| Indirect costs | | | | | |
| Depreciation - diesel | quintals | 8 | 0.72 | 5.78 | 3% |
| Depreciation | quintals | 8 | 1.59 | 12.70 | 8% |
| Annual maintenance | quintals | 8 | 0.91 | 7.25 | 4% |
| Paper | quintals | 8 | 0.84 | 6.71 | 4% |
| Accounting | quintals | 8 | 1.01 | 8.05 | 5% |
| Administration | quintals | 8 | 3.77 | 30.19 | 18% |
| | | | | 70.67 | |
| Subtotal of processing cost | | | | 165.23 | 100% |
| Cardamom cultivation | quintals | 40 | 15.09 | 603.77 | |
| Transport | quintals | 8 | 5.66 | 45.28 | |
| COST (of cardamom processing) | | | | 814.29 | |
| <i>COST (per quintal of processed cardamom)</i> | | | | 101.79 | |
| INCOME | | | | | |
| Cardamom pergamino | quintals | 8 | 125.79 | 1,006.29 | |
| <i>Income per quintal</i> | | | | 125.79 | |
| BALANCE (8 quintals of processed cardamom) | | | | 192.00 | |
| <i>Balance per quintal</i> | | | | 4.80 | |
| PROFIT | | | | 23.6% | |

Profitability of the processing operation is 23.6% (or US\$ 4.80 per quintal). The cost of energy (wood and diesel) and depreciation of the diesel engine in the processing of cardamom is about 28% of total cost, as is indicated in the table above. The diesel can be replaced by using motors powered by electricity from a local hydropower facility. This will reduce the cost of the energy input and depreciation of the diesel engine. At a tariff of \$ 0.20/kWh profitability increases to 25% (or \$ 5.04 per quintal). Even at the full cost of energy production of the hydropower facility at US\$ 0.31 per kWh (based on the analysis in Table 9); profitability will be the same as when using a diesel engine. Employing solar thermal energy reduces about 40% of the heat requirements provided by wood. This further reduces the cost of fuel, but increases the investment cost because the solar dryer technology has to be acquired. The savings in wood purchase will be largely offset by the additional investment, but the savings in wood consumption has considerable environmental benefit as most of the wood used is not produced in a sustainable way. At a production of 1,000 quintals a year this implies savings of 3,125 liters of diesel and of 2,000 m³ of wood.

Assumptions:

- Investment cost of 9 kW diesel engine: US\$ 2,750; discount rate: 10%, lifetime: 10 years; O&M cost: \$ 275 annually. Total cost per quintal *pergamino* of \$ 0.72.
- Production of 1,000 quintals of *pergamino* annually
- Investment cost of solar dryers: US\$ 5,000 (assuming a lifetime of 15 years and a discount rate of 10%).

Box 3 Cost estimates of drying and processing organic cardamom (cont'd)

Energy inputs: wood and MHP electricity

| Concept | Units | Quantity | Unit price (US\$) | Value (US\$) | Percentage |
|---|----------|----------|-------------------|--------------|------------|
| Indirect costs | | | | | |
| <i>Inputs</i> | | | | | |
| Wood | m3 | 5 | 5.03 | 25.16 | 15% |
| Diesel | gallons | 0 | 3.27 | - | 0% |
| Electricity | kWh | 90 | 0.20 | 17.90 | 11% |
| Sacks | units | 10 | 0.63 | 6.29 | 4% |
| | | | | 49.35 | |
| <i>Labour</i> | | | | | |
| Pickers | task | 1 | 18.87 | 18.87 | 11% |
| Helper | task | 1 | 12.58 | 12.58 | 8% |
| Additives | quintals | 8 | 1.26 | 10.06 | 6% |
| | | | | 41.51 | |
| Indirect costs | | | | | |
| Depreciation | quintals | 8 | 1.59 | 12.70 | 8% |
| Annual maintenance | quintals | 8 | 0.91 | 7.25 | 4% |
| Paper | quintals | 8 | 0.84 | 6.71 | 4% |
| Accounting | quintals | 8 | 1.01 | 8.05 | 5% |
| Administration | quintals | 8 | 3.77 | 30.19 | 18% |
| | | | | 64.89 | |
| Subtotal of processing cost | | | | 155.75 | 100% |
| Cardamom | quintals | 40 | 15.09 | 603.77 | |
| Transport | quintals | 8 | 5.66 | 45.28 | |
| COST (of cardamom processing) | | | | 804.81 | |
| <i>COST (per quintal of unprocessed cardamom)</i> | | | | 20.12 | |
| INCOME | | | | | |
| Cardamom pergamino | quintals | 8 | 125.79 | 1,006.29 | |
| <i>Income per quintal</i> | | | | 25.16 | |
| BALANCE (8 quintals of processed cardamom) | | | | 201.48 | |
| <i>Balance per quintal</i> | | | | 5.04 | |
| PROFIT | | | | 25.0% | |

Energy inputs: wood, MHP electricity and solar drying

| Concept | Units | Quantity | Unit price (US\$) | Value (US\$) | Percentage |
|---|----------|----------|-------------------|--------------|------------|
| Indirect costs | | | | | |
| <i>Inputs</i> | | | | | |
| Wood | m3 | 3 | 5.03 | 15.09 | 9% |
| Diesel | gallons | 0 | 3.27 | - | 0% |
| Electricity | kWh | 90 | 0.20 | 17.90 | 11% |
| Sacks | unidades | 10 | 0.63 | 6.29 | 4% |
| | | | | 39.29 | |
| <i>Labour</i> | | | | | |
| Pickers | task | 1 | 18.87 | 18.87 | 11% |
| Helper | task | 1 | 12.58 | 12.58 | 8% |
| Additives | quintals | 8 | 1.26 | 10.06 | 6% |
| | | | | 41.51 | |
| Indirect costs | | | | | |
| Depreciation - solar | quintals | 8 | 0.79 | 6.31 | 4% |
| Depreciation | quintals | 8 | 1.59 | 12.70 | 8% |
| Annual maintenance | quintals | 8 | 0.91 | 7.25 | 4% |
| Paper | quintals | 8 | 0.84 | 6.71 | 4% |
| Accounting | quintals | 8 | 1.01 | 8.05 | 5% |
| Administration | quintals | 8 | 3.77 | 30.19 | 18% |
| | | | | 71.20 | |
| Subtotal of processing cost | | | | 152.00 | 100% |
| Cardamom | quintals | 40 | 15.09 | 603.77 | |
| Transport | quintals | 8 | 5.66 | 45.28 | |
| COST (of cardamom processing) | | | | 801.06 | |
| <i>COST (per quintal of processed cardamom)</i> | | | | 20.03 | |
| INCOME | | | | | |
| Cardamom pergamino | quintals | 8 | 125.79 | 1,006.29 | |
| <i>Income per quintal</i> | | | | 25.16 | |
| BALANCE (8 quintals of processed cardamom) | | | | 205.23 | |
| <i>Balance per quintal</i> | | | | 5.13 | |
| PROFIT | | | | 25.6% | |

238. In terms of profitability, applying solar dryers would be neutral; the savings in wood purchases would largely be offset by the higher cost of investment, but will imply a considerable positive environmental impact by means of reducing wood consumption by 40% in compared with the current use.
239. At the level of cardamom production in Seasir (around 270 quintals of *pergamino*), a standard dryer of 40 quintals per day would only be used for about 1-2 weeks days a year! At such a low capacity utilization level, the facility would still make a profit of some 14-17%, but if it is questionable whether the dryer would be competitive in comparison with the larger facilities available in Cahabón or elsewhere. A similar facility in Jolom Ijix (producing 750 quintals of cardamom) would have a profitability of 22-24%.
240. The PURE in Guatemala project will aim therefore (with MAGA and other co-financing support) to remove non-energy barriers by promoting the increase in productivity of cardamom cultivation and/or increasing the area under cultivation and local capacity building. Also, nearby communities will be encouraged to have their cardamom processed in Seasir which could thus acts as a small centre of processing in its surrounding 'micro-region'.
241. Simultaneously, the PURE initiative aims at removing the energy-related barriers (with GEF) support for local capacity building in establishing the MHP station.

7.5 Ecotourism

Tourism market in Guatemala

242. Tourism plays an important in the Guatemalan economy. Tourism generated US\$ 770 million in 2004, compared with exports of coffee (\$ 425 million), sugar (\$ 444 million), bananas (\$ 278 million) and cardamom (\$ 99 million). In 2004, some 1.2 million international tourists visited Guatemala, implying an average spending of US\$ 640 per tourist. With the restoration of democracy and the end of violent conflict, the number of tourists has been increasing from around 200,000 in 1983 to 1.2 million in 2004.
243. Tourists mainly coming from Central America (El Salvador), north America and Europe, ranging from backpackers and individual travelers to those that come on package trip offered by tour operators. Also, the number of Guatemalan residents that travel within Guatemala is increasing, e.g. the number of nationals that visited the Tikal National Park increased from 60,000 during 1985-1989 to 507,000 in 2000-2004 (in comparison with 222,000 and 550,000 foreign tourist in the same periods respectively).
244. Guatemala is blessed with a wide range of attractions that draw the bulk of tourists:
- Archeological, e.g. Tikal in El Petén,
 - Indigenous culture: markets, handicrafts and other elements of Mayan culture, e.g. Chichicastenango and the villages around Lake Atitlán,
 - Historical: colonial towns, such as Antigua,
 - Nature, e.g. Lake Atitlán, Río Dulce and the national reserves (*biotopos*)
 - Costal areas, i.e. the Caribbean and the Pacific coasts.
245. National and adventurous international tourists also tend to visit other places, such as lakes, volcanoes, caves, waterfalls and villages that are 'off the beaten track'. One such place is Balneario Las Conchas at the Chiyú River close to the Sepemech waterfalls.

Potential for expanding ecotourism in Las Conchas

246. In 2005 some 3,060 tourists visited the site (of which 2,866 national and 194 international tourists) generating benefits for the site of US\$ 4,340. Most tourists tend to come in the period March-May, corresponding with the *Semana Santa* holiday period and the dry season in Guatemala, and to a lesser extent in December-January. Most tourists come from the surrounding areas; the number of other

national and international tourists visiting is small, which can be attributed to fact that the site is not on the itinerary of tour operators, lack of information and promotion by travel agencies and, last but not least, to the lack of appropriate infrastructure and facilities.

247. Balneario Las Conchas offers a high potential to be developed as a tourist site for both national and international tourists, being close to Cobán (capital of the Alta Verapaz province) and the Río Dulce -El Petén area. To be able to seize this opportunity, a number of actions need to be taken :
- To improve road access to the area,
 - To improve the area at the site (restaurants, swimming pool, zoo, public lighting, souvenir shop, security, more bungalows or a small hotel),
 - To promote the site and its improved facilities to tour operators and tourist agencies based in the capital as well as in nearby towns,
 - To improve the facilities (e.g., having private bathrooms in each bungalow),
 - To provide electricity to the facilities.
248. At present, the Chahal municipality directly administers the *turicentro*. As the municipality budget procedures do not allow to make large investments, it has been suggested that the municipality gives a concession to a local organization to manage the site and make the necessary investments in its infrastructure. To ensure that the local community is engaged, this local organization will be in the form of an Association, called Community Tourism Council, consisting of representatives of the communities and the institutions involved (e.g., municipality) whose day-to-day operations would be led by a manager, an assistant and other staff.
249. Based on growth trends in the economy and tourism in Guatemala, the case study of the Balneario Las Conchas projects that the number of visitors will grow from the current 3,000 (2004) to 4,600 (2007) and 6,500 (in 2009). Based on this projection and the need for infrastructural improvements, indicated above, a financial plan was set up of which the details are given in Table 12:
- Initial investment of US\$ 37,220 (of which \$ 13,000 for electrical equipment)
 - Annual operating cost of \$ 12,720 (of which about 25% are electricity cost at \$ 0.20/kWh)
 - Annual revenue by selling visitor tickets, handicraft sales and restaurant of \$ 15,300 (2007), \$ 21,850 (2008) and \$ 26,250
 - Net present value of \$ 73,840 (over 10 years at 10% discount rate) and internal rate of return of 25%.
250. The profitability indicators are quite affected by the cost and amount of the energy inputs, as is indicated below in the table below. An affordable and reliable supply of electricity is a prerequisite therefore for the economically viable functioning of a modern *turicentro*.

| Consumption (kWh year) | Tariff US\$/kWh | NPV (US\$) | IRR |
|---------------------------|--------------------|---------------|-----|
| 6 | 0.3 | 32,031 | 17% |
| | 0.15 | 94,749 | 29% |
| 3 | 0.3 | 94,749 | 29% |
| | 0.15 | 126,107 | 35% |

on topics such as local decision-making, natural resource management, local education and on-the-job training (linked with receiving and servicing tourists) to be supported by MAGA and other co-financing. Local training and capacity building on energy-related issues (i.e., operation and administration of the micro hydropower facility is supported by GEF funding).

8. BUSINESS PLANS FOR DELIVERY OF ENERGY FOR SOCIAL AND PRODUCTIVE USES

8.1 The experience of Chel

The Chel Micro Hydropower Project

252. The Chel Micro Hydro Project is projected to have a capacity of 165 kilowatts (kW) and will be connected to a mini-grid supplying electricity to a community of almost 2,500 people living in the three small villages of Chel, Las Flores and Xesayi located about 44 km north of the municipal capital of Chajul in the Department of El Quiche (about 170 km from the capital city of Guatemala).

Participation and organization

253. Guatemala's 36-year civil war had severe repercussions in the northern part of the country, leaving communities isolated and lacking water, energy and transportation services. In 1982, over 95 people in the Chel community were massacred. Exiled community leaders came across many micro hydropower facilities operating throughout Guatemala and concluded that small-scale hydropower could present a solution to Chel's energy needs. On their return and resettlement, a pre-feasibility study was carried out with USAID support. The villagers then contacted Fundación Solar in 2000 to bring the hydropower technology to their village.
254. Fundación Solar provided critical technical support and social development in Chel. The project presented both technical (due to its geographic isolation) and social challenges, (due to deep ethnic, cultural and political divisions within the community and a lack of trust of outside organizations, a consequence of the war). After having gained trust, cooperation was achieved. The Chel Project is based on the participation of local villagers, through their formation and development of the local Chel Hydroelectric Association (*Asociación Hidroeléctrica Chelense*, A.H.Ch.). The Association was established with the support of Fundación Solar in 2001 with the objective to establish and operate the future electric facility in Chel.
255. As decided by the Association, 80 days labor contribution per family was the price of entry into the system, connection to the grid and home wiring. The community contributed enormous effort to the construction of the hydropower plant. At the onset of construction there were already 572 individual village participants to begin the series of civil structures needed to support the project. Construction of the MHP facility started in 2003 and will be finished in 2006. The community hand-build the mountain road last year in order to transport the equipment for their micro hydro system. When the rivers were too high to traverse, teams of men carried the huge electrical poles on their backs for miles along the road they themselves to reach the remote community.
256. The Association is governed by a General Assembly of members and run by an Executive Board. A.H.Ch. is run like an enterprise and has ventured into other community services as well, such as community telephone, transportation and providing credit to its members. Recently, the A.H.Ch. proposed the construction of a 1.5 MW mini hydropower station to be connected to the national grid for power sales.

Lessons learned

257. Although the MHP station is not in operation yet, the prospect of receiving electricity soon has already given a boost to the local economy in Chel and attracted micro and small businesses. Over the past

year, the number of shops has increased from 10 to about 40. Chel now has a *cantina*, butcher shop, hardware/repair shop, bookstore, poulterer's shop and an ice-making shop. As soon as power is available, the gasoline-powered engines of the two maize mills will be replaced by electric engines. The *Asociación Chelense* is planning to install coffee processing facilities as well.

258. This growth in the number of income-generating activities in Chel, even before the MHP is operating, shows another phenomenon, namely that the socio-economic impacts go beyond the border of the communities that directly benefit from the MHP. In other words, Chel is starting to grow and convert itself into a center for the small villages surrounding it; in this 'micro-region' Chel serves as a center providing social services and economic opportunities.
259. One reason for the success of Chel has been that an integrated approach was followed to promote development in terms of organization and capacity building, social services and infrastructure and productive uses. When starting with the project, Fundación Solar focused heavily in the first two years on:
- Inter-institutional coordination with local authorities, community leaders and NGOs active in the area to achieve a common understanding regarding development and the role of energy services (to be provided by the MHP);
 - Awareness creation amongst the beneficiaries and capacity building of community leaders and members on administrative and technical issues. Here, the key point is that the beneficiaries should not only be informed, but should be heavily engaged (i.e. have shared control in decision making). In Chel, the A.H.Ch. has taken 'ownership' and has pro-actively been involved, not only in preparing and implementing the MHP project, but in other community activities (e.g., communications) as well.

Financing and tariff definition

260. The cost of initial investment will be financed from a mix of sources, mostly grant money. Table 13 gives an example of the financing scheme of the Chel MHP.
261. Operation and maintenance cost are an estimated US\$ 20,000 (or about 2.6% of total investment cost), of which some US\$ 6,100 for maintenance and US\$ 13,900 for operation and administration (staff of the plants, travel cost, office supplies, communications, documentation and training).

Table 13 Breakdown of investment cost and source of finance of Chel MHP

| | | Amount (US\$) |
|--|---|---------------|
| Project Reconciliation in Conflict zones (PNUD - USAID) | Electromechanical equipment | 34,900 |
| Project Assistance to Victims of Human Rights Violations (PNUD -USAID) | Civil works | 36,000 |
| Program Quiché (EU) | Civil works (materials) | 52,300 |
| Municipality of Chajul | Civil works (transport) | 6,700 |
| National Electrification Institute (Government) | Transmission & distribution | 92,700 |
| Social Investment Fund (Government) | Civil works (materials), planning and supervision | 198,100 |
| National Fund for Peace (Government) | Electromechanical equipment | 69,000 |
| Green Empowerment | Electromechanical equipment | 13,200 |
| OAS/USAID | Construction | 14,900 |
| Sandia National Laboratories | Powerhouse, final design | 34,500 |
| Community (beneficiaries) | Local materials, labor | 92,900 |
| Fundación Solar (loan) | Construction | 39,700 |
| A.H.Ch. | House wiring and public lighting | 27,000 |
| Other | Civil works and final design | 69,500 |
| Total | | 781,400 |

Source: Fundación Solar (2006d)

8.2 Mini/micro hydropower (MHP) facilities in the project areas

Technical and economic analysis

262. In the three other project areas that were studied in the PDF B (Las Conchas, Seasir and Jolom Ijix) a micro hydropower (MHP) station with a capacity of around 100-200 kW will be installed. The capacities have been designed to accommodate not only the household energy needs (basically for lighting) but (future) productive uses as well.
263. Table 14 presents a compilation of the project profiles in the four project area, giving a summary of the energy demand, technical characteristics of the plants, costs data and economic indicators.
264. For the economic analysis of this report, the electricity demand in the four sites has been assessed and summarized in Table 15. The aim of power supply is to provide enough electricity to secure three tasks:
 - Basic electricity for households for powering a few light points (with TLs and bulbs) and small electric appliances
 - Provide power for social services, such as schools, clinic, communal TV and telecommunications
 - Productive value-adding and income-generating activities, such as agricultural processing (maize milling; drying of coffee and cardamom), tourist facilities (in Las Conchas), small shops (tailor, restaurant, carpenter, welder, ice-making, grocery) and wood processing (in Seasir).
265. Thus, the capacity of the MHP station should not only be able to meet current demand, but also be able to accommodate future demand by an increased population, expanded social services,, improved existing as well as new productive uses.
266. The economic analysis of Table 16 is further based on the technical design costs estimated in earlier analysis by Fundación Solar (2004, 2005, 2006d) as given in Table 12. The investment cost (per kW of installed capacity) differs slightly due to different conditions at the construction sites. Since operational cost are directly related to investment cost (taken as 2.5%) these are similar at all sites. The cost of energy produced (the sum of annualized investment cost and annual O&M cost divided by the annual energy production) tend to differ per site, depending on the initial investment cost and the plant's capacity (or load utilization) factor.
267. The load (plant utilization) factors of the plants vary between 30-45%. The cost of energy production (investment and operating costs) varies between US\$ 0.25-0.58 (if the plant was operating in 2006) and US\$ US\$ 0.17-0.36 per kWh (in 2016, when there will be more paying consumers due to population and economic growth).
268. It is assumed that households and social services are charged US\$ 0.12 per kWh, which is equal to the social tariff currently charged by the power distribution companies EEGSA, DEOCSA and DEORSA to their grid-connected clients. It is assumed that the productive uses of energy (PUE) are charged US\$ 0.20 per kWh (the tariff charged by the above-mentioned companies to consumers that consume less than 300 kWh/year). It should be noted that the social tariff of US\$ 0.12/kWh implies a monthly expenditure of about US\$ 8.60 for the average household. This is in the same order what rural households in the four areas currently spend on fuels (kerosene, torch batteries), except that now they will access a much better energy service.

Table 14 MHP Project profiles

| | Chel | Las Conchas | Seasir, Rio Chahabon | Jolom Ijix |
|--|----------------|----------------------|-----------------------------|----------------------|
| | Chajul, Quiché | Chahal, Alta Verapaz | Cahabon, Alta Verapaz | Panzos, Alta Verapaz |
| <i>Demographic information</i> | | | | |
| • Number of households (in 2006) | 440 | 303 | 150 | 86 |
| • Number of households (in 2016) | 660 | 455 | 225 | 129 |
| • Number of commercial users and services | 39 | 33 | 19 | 12 |
| <i>Installed capacity (kW)</i> | 165 | 190 | 90 | 60 |
| <i>Annual energy demand (MWh)</i> | 655.1 | 443.5 | 207.6 | 161.6 |
| • Productive uses and commercial | 86.7 | 83.5 | 67.7 | 66.2 |
| • Private households and services | 584.6 | 360.0 | 208.8 | 125.9 |
| • Average load factor | 47% | 27% | 36% | 38% |
| <i>Technical data on MHP</i> | | | | |
| • Gross head (m) | 101 | 14.5 | 300 | 100 |
| • Designed discharge (liters/sec) | 360 | 2,420 | 63 | 45 |
| • Headrace channel (m) | 34 | 2,100 | | 1,000 |
| • Transmission line (km) | 3.2 | 4.5 | | |
| • Distribution line (km) | 4.5 | 7.0 | | |
| <i>Total investment cost (US\$)</i> | 781,400 | 1,338,050 | 657,300 | 406,100 |
| • Civil works | 404,750 | 675,100 | 273,800 | |
| • Electromechanical equipment | 117,200 | 330,100 | 226,200 | |
| • Transmission and distribution | 117,200 | 332,850 | 127,300 | |
| • Planning, final design and supervision | 142,250 | 40,000 | 30,000 | |
| <i>Operation and maintenance (US\$)</i> ⁴ | 19,535 | 33,450 | 16,435 | 10,155 |
| <i>Estimated annual revenue (US\$)</i> | 84,240 | 59,900 | 38,590 | 28,350 |
| <i>Total energy production cost (US\$)</i> | | | | |
| • Annuity of investment (20 years, 10%) | 91,785 | 157,165 | 77,200 | 47,700 |
| • Energy production cost (US\$/kWh) | 0.17 | 0.43 | 0.34 | 0.30 |
| • Investment cost per kW (US\$) | 4,740 | 7,040 | 7,300 | 6,770 |
| <i>GHG emission reduction (tCO₂)- 20 yrs</i> ⁽⁴⁾ | 27,060 | 18,320 | 11,420 | 7,940 |

Source of data:

- Annual energy demand and demographic information: see Table 7
- Installed capacity, technical data and investment on MHP: Fundación Solar (2004), Fundación Solar (2005), Fundación Solar (2006d)
- O&M cost, estimated revenues and total energy production cost: see Table 8
- Carbon dioxide emission reduction estimate: see Table 11

269. At these tariffs and load factors, it is clear that none of the plants would be viable if all costs would have to be borne by the beneficiaries themselves, especially not in the first years of operation when energy demand is lower. However, with the above-mentioned social and PUE tariffs, revenues are enough to cover operation and maintenance costs and to allow in addition to build up some reserves for future expansion or unexpected events or even for venturing in to non-energy activities, such as the A.H.CH (Chel) is doing.

Table 15 Power demand in Chel, Las Conchas, Seasir and Jolom Ijix

| | Number | kW | Sum | Hours | kWh per Month | Months operating | 2016 | |
|---------------------------------|--------|-----|------|-------|---------------|------------------|---------------------|--------------|
| | | | | | | | MWh annually | |
| <i>(1) PUE</i> | | | | | | | | |
| Repair shops | 3 | 1 | 3 | 8 | 720 | 12 | 8.6 | |
| Shops | 30 | 0.4 | 12 | 8 | 2,880 | 12 | 34.6 | |
| Mill | 2 | 2.7 | 5.4 | 4 | 648 | 12 | 7.8 | |
| Coffee and cardamom | 2 | 9 | 18 | 10 | 5,400 | 4 | 21.6 | |
| Subtotal | 37 | | 38.4 | | 9,648 | | 72.6 | |
| <i>(2) Households (in 2006)</i> | | | | | | | | |
| Number (in 2016) | 660 | 0.3 | 198 | 8 | 47,520 | 12 | 570.2 | |
| <i>(3) Schools and services</i> | | | | | | | | |
| | 2 | 3 | 6 | 8 | 1,440 | 10 | 14.4 | |
| <i>Load factor:</i> | | | | | | | TOTAL DEMAND | 657.2 |
| - with PUE | | | | | | | 45% | |
| - without PUE | | | | | | | 40% | |

| Las Conchas | Installed capacity | | | | kWh per Month | Months operating | 2016 MWh annually | |
|---------------------------------|--------------------|-----|--------|-------|---------------|------------------|---------------------|--------------|
| | Number | kW | Sum | Hours | | | | |
| <i>(1) PUE</i> | | | | | | | | |
| Repair shops | 3 | 1 | 3 | 8 | 720 | 12 | 8.6 | |
| Shops | 20 | 0.4 | 8 | 8 | 1,920 | 12 | 23.0 | |
| Mill | 3 | 2.5 | 7.5 | 4 | 900 | 12 | 10.8 | |
| Coffee & cardamom | 2 | 9 | 18 | 10 | 5,400 | 4 | 21.6 | |
| Tourist facility | 1 | 6 | 6 | 8 | 1,440 | 10 | 14.4 | |
| Water pump | 2 | 1 | 2 | 10 | 600 | 12 | 7.2 | |
| Subtotal | 31 | | 44.5 | | 10,980 | | 85.7 | |
| <i>(2) Households (in 2006)</i> | | | | | | | | |
| Number (in 2016) | 455 | 0.3 | 136.35 | 8 | 32,724 | 12 | 392.7 | |
| <i>(3) Schools and services</i> | | | | | | | | |
| | 2 | 3 | 6 | 8 | 1,440 | 10 | 14.4 | |
| <i>Load factor:</i> | | | | | | | TOTAL DEMAND | 492.8 |
| - with PUE | | | | | | | 30% | |
| - without PUE | | | | | | | 24% | |

| Seasir | Installed capacity | | | | kWh per Month | Months operating | 2016 MWh annually | |
|---------------------------------|--------------------|-----|------|-------|---------------|------------------|---------------------|--------------|
| | Number | kW | Sum | Hours | | | | |
| <i>(1) PUE</i> | | | | | | | | |
| Repair shops | 2 | 1 | 2 | 8 | 480 | 12 | 5.8 | |
| Shops | 10 | 0.4 | 4 | 8 | 960 | 12 | 11.5 | |
| Mill | 2 | 2 | 4 | 4 | 480 | 12 | 5.8 | |
| Sawmill | 1 | 70 | 70 | 3 | 6,300 | 4 | 25.2 | |
| Coffee & cardamom | 2 | 9 | 18 | 10 | 5,400 | 4 | 21.6 | |
| Subtotal | 17 | | 98 | | 13,620 | | 69.8 | |
| <i>(2) Households (in 2006)</i> | | | | | | | | |
| Number (in 2016) | 225 | 0.3 | 67.5 | 8 | 16,200 | 12 | 194.4 | |
| <i>(3) Schools and services</i> | | | | | | | | |
| | 2 | 3 | 6 | 8 | 1,440 | 10 | 14.4 | |
| <i>Load factor:</i> | | | | | | | TOTAL DEMAND | 278.6 |
| - with PUE | | | | | | | 35% | |
| - without PUE | | | | | | | 26% | |

| Jolom Ijix | Installed capacity | | | | kWh Month | Months | 2016 MWh annually | |
|---------------------------------|--------------------|-----|------|-------|-----------|--------|---------------------|--------------|
| | Number | kW | Sum | Hours | | | | |
| <i>(1) PUE</i> | | | | | | | | |
| Repair shops | 1 | 1 | 1 | 8 | 240 | 12 | 2.9 | |
| Shops | 5 | 0.4 | 2 | 8 | 480 | 12 | 5.8 | |
| Mill | 2 | 2 | 4 | 4 | 480 | 12 | 5.8 | |
| Coffee and cardamom | 2 | 9 | 18 | 10 | 5,400 | 4 | 21.6 | |
| Subtotal | 10 | | 25 | | 6,600 | | 36.0 | |
| <i>(2) Households (in 2006)</i> | | | | | | | | |
| Number (in 2016) | 129 | 0.3 | 38.7 | 8 | 9,288 | 12 | 111.5 | |
| <i>(3) Schools and services</i> | | | | | | | | |
| | 2 | 3 | 6 | 8 | 1,440 | 10 | 14.4 | |
| <i>Load factor:</i> | | | | | | | TOTAL DEMAND | 161.9 |
| - with PUE | | | | | | | 31% | |
| - without PUE | | | | | | | 24% | |

Source of data: own estimates, based on Fundación Solar (2006d) and other information

Table 16 Cost comparison diesel generator and micro hydropower

| Generator set | | Hydropower | |
|--------------------------------------|----------------|---|----------------|
| <i>Base data</i> | | <i>Base data</i> Micro | |
| Capacity (kW) | 100 | Capacity (kW) | 100 |
| Type of fuel used | Diesel | Cost equipment (US\$/kW) | 1,600 |
| Price (US\$/litre) | 0.86 | Life (years) | 20 |
| Generator efficiency (%) | 34% | Capacity factor | 30% |
| Life (years) | 10 | Annual energy produced (kWh) | 262,800 |
| Capacity factor (%) | 30% | Operation & maintenance | 2.5% |
| Annual energy produced (kWh) | 262,800 | <i>Investment cost (US\$)</i> | |
| Number of hours operated | 2628 | - Electromechanical equipment | 160,000 |
| Overhaul | 10% | - Civil works | 300,000 |
| - years | 3 | - Transmission and distribution | 120,000 |
| Operation & maintenance | 2.5% | TOTAL | 580,000 |
| <i>Investment cost (US\$)</i> | | <i>Annual cost (US\$)</i> | |
| - Equipment | 20,000 | - Levelised investment cost | 68,127 |
| - Civil works | 2,500 | - Operation and maintenance | 14,500 |
| - Transmission and distribution | 120,000 | TOTAL | 82,627 |
| Total | 142,500 | <i>Cost of production (US\$/kWh)</i> | |
| <i>Annual cost (US\$)</i> | | - full (no subsidy on investment) | 0.31 |
| - Levelised cost | 23,191 | - only covering O&M cost | 0.06 |
| - Overhaul | 5,730 | | |
| - Operation and maintenance | 3,563 | | |
| Fuel | 56,768 | | |
| Total | 89,252 | | |
| <i>Cost of production (US\$/kWh)</i> | | | |
| | 0.34 | | |

Source: own estimates, based on international prices of diesel generators and hydropower turbines, taking into account cost of MHP civil works and transmission and distribution, as given in Table 6. A discount factor of 10% is used.

270. This does imply that (large) part of the investment will have to be financed by grants from the government, national or international donor organization. An example of such a financing mix is given for the case of Chel (see Table 3), in which investment was covered for 78% by grant money. Similar financing schemes, with funding from different sources, will be developed for Las Conchas, Seasir and Jolom Ijix. In this respect, JICA has shown interest and will contribute US\$ 500,000 as part of the rural energy process in Guatemala supported by the Global Village Energy Partnership (GVEP).
271. The development of productive uses of energy helps to increase the plant's utilization factor, in the examples given in Table 16 with about 5-11%. The higher the plant utilization factor, the higher the higher the energy consumption by paying clients, the higher the revenues, thus bringing the MHP closer to economic viability.
272. Micro hydropower is the least cost option when compared with the alternative of a village mini-grid powered by a diesel generator. Table 17 compares the economics of a 100 kW micro hydropower station with a 100 kW diesel generator. In general, the advantage of generators lays in their ability to provide power on demand and have lower capital cost, but much higher operating and maintenance cost (due to the diesel consumption) than a MHP station.

Community based management of micro hydropower

273. Centrally owned and operated power stations often have to struggle with conflicts of interest, low motivation of public workers, high bureaucratic rules and regulations (e.g. revenues have to be transferred back to the central budget, from which expenditures have to be transferred back) and lack of transparency in decision making and cash flows, while locally available capacities and know-how are not considered. Often sustainable operation cannot be achieved, due to low interest in bill collection, tolerance of illegal consumption and low consumption rates.
274. An optimized management structure for a rural power station is best organized locally, in which responsibility and decision making are located as near as possible to the power station and the beneficiaries themselves. The organization scheme promoted by Fundación Solar is that of the Local Organization for the Administration of Energy Projects, known by its Spanish acronym as OLAPE⁶³. Key concept is the participation of local groups in the development and management of projects, allowing them to share in the costs and the benefits and allowing their organization to attract outside investment.
275. Legally, the OLAPE can take several forms:
- Community-owned company (association, cooperative or incorporated),
 - Municipal company or consortium of municipal companies,
 - Mixed capital company (with participation of municipalities, central government, communities and private sector),
 - Privately owned company
276. Sustainable management by the communities themselves includes a number of conditions, which are the following:
- The concerned villagers, including all electricity consumers, form a 'general assembly' that selects a 'management committee' or 'board of directors';
 - The 'management committee' selects the staff of the company, namely the manager and personnel responsible for billing and bookkeeping, for collection and payment of bills and one external auditor for the bookkeeping and auditing of the funds in the MHP bank account;
 - Where possible and viable, metered consumption-based payment is preferred over setting monthly flat fees per household;
 - All participating households should contribute in cash and/or in labor force according their financial possibilities and time availability;
 - The manager and 'management committee' should propose a tariff that covers operation and maintenance cost and future expansion/investments. The general assembly and/or management committee should decide on preferential treatment for poor households;
 - The president of the management committee should inform the general assembly of villagers about the ongoing MHP performance, financial situation and bookkeeping in an annual meeting, in which also the auditor has to report all financial transactions and provide a clearance certificate.

8.3 Impacts and benefits

Social and economic impacts

277. Access to electricity contributes to poverty alleviation and livelihood improvement. Electricity is essential for the provision of quality community services, such as educational and health services. It can also have positive impacts on rural households, particularly women and children, who bear the main responsibility for household work. Access to lighting (and communication, e.g. through a mobile) improves the living conditions of each household. Availability of electricity in a village improves its attractiveness of the community for professional people, such as teachers and medical staff.

⁶³ OLAPE: *Organización Local para la Administración de Proyectos de Energía*

278. Access to electricity is an essential pre-condition for improving the living conditions in rural areas through initiating local economic activities, the creation of job and income opportunities and improvement of social services (health, education). Skilled jobs are created or encouraged through the operation and administration of the village power station itself and the demand for repair of electric appliances and machinery. Services like small retail shops and workshops (masonry, wood work, welding, etc.) also create jobs and improve the access of the villagers to locally available services (which often result in additional cost savings due to reduced transportation cost and time). Electricity can add value by the local processing of crops, as was discussed for cardamom and coffee, or by encouraging new activities (such as local wood production and processing and ecotourism).
279. Apart from productive uses, electricity substitutes other energy sources that are currently used in households, such as kerosene or batteries used for lighting, giving them a much improved energy service. Last, but not least, the new designs of optimized micro hydropower equipment as well as the higher demand for electro-mechanical equipment could contribute to the development of the national supply market for hydropower equipment.
280. After the successful installation of new micro hydropower plants the following benefits are expected:
- *At the MHP sites:*
 - The professional self-management of the MHP will be ensured by further on-the-job training by the employees and the supervising management committee. At each site various new jobs are created in conjunction with the plant, such as manager, operators, fee collectors and administrative and accounting staff.
 - Funds are established for repair, maintenance and future expansion works
 - *At the household level:*
 - Electricity consumption at the household level will increase by 30-50%. New equipment and better lighting will reduce the workload for women and save time to be used for productive and income generating activities (e.g., weaving, tailoring and production of souvenir items for tourists)
 - Improvements in the agricultural practices of cultivating cash crops (cardamom, coffee) will bring in additional income for the farming household
 - *Agro-processing and other PUE:*
 - Improvements in the local processing of cardamom and coffee by producing *pergamino* quality instead of selling the fruits (providing value added per kilogram of crop produced) and by replacing MHP-generated electricity for the more expensive diesel engines (lowering the cost of processing)
 - Investments by craftsmen and repair shops in electrical tools to expand their businesses.
 - New shops will come up as soon as electricity (and other facilities such as telecommunications) is available.
 - Ecotourism facilities will be expanded or newly set up, providing additional employment and adding value to the community
281. The socio-economic impacts go beyond the border of the communities that directly benefit from the MHP. Experience with other sites (e.g. the Chel project, in which Fundación Solar has been involved) has shown that the community provided with access to electricity starts attracting shops and services and thus converting itself into a center for the *micro-region* small villages surrounding it by providing social services (school, health center) and economic opportunities.
282. Table 18 presents an approximate quantification of the income generation impacts of some of the opportunities and developments described in this report:

Table 17 Expected annual income generation at proposed sites

| | Chel | Conchas | Seasir | Jolomijix | Total |
|--------------------------------------|----------------|---------------|---------------|---------------|----------------|
| Households (2006) | 440 | 303 | 150 | 86 | 979 |
| Expected income generation (US\$/yr) | | | | | |
| Coffee processing | 73,000 | 41,000 | 13,000 | 26,000 | 153,000 |
| Cardamom processing | 41,000 | 23,000 | 6,000 | 16,000 | 86,000 |
| Tourism | | | 7,000 | | 7,000 |
| Increased shop revenues | 10,000 | 6,000 | 3,500 | 2,000 | 21,500 |
| Total | 124,000 | 70,000 | 29,500 | 44,000 | 267,500 |

Assumptions:

- Value added of coffee production: (a) 150% increase in production, (b) price difference between processed coffee (US\$ 79 per quintal pergamino) and production of coffee cherries (US\$ 57 per quintal pergamino)
- Value added of cardamom production: a) 120% increase in production, (b) price difference between processed cardamom (US\$ 126 per quintal pergamino) and production cost of cardamom (US\$ 75 per quintal pergamino)
- Calculations are based on average annual production figures for Seasir (coffee: 274 quintals, cardamom: 270 quintals) and Jolomijix (coffee: 535 quintals, cardamom: 746 quintals)
- Tourism: average annual profit as given in Table 4
- Shop revenues: own estimate

Environmental impacts

283. The use of micro hydropower contributes to the avoidance of greenhouse gases that would otherwise have been emitted in the case of a diesel generator powering the village mini-grid. Table 19 below compiles the avoided greenhouses in the four areas due to the operation of MHP.
284. The total figure amounts up to 62,870 tons of saved emissions of CO₂ during the lifetime of the four power stations. In monetary terms, this is equivalent to US\$ 628,700 at a rate of US\$ 10 per ton of CO₂ or US\$ 62,780 annually.

Table 18 Greenhouse gas abatement by MHP

| | Reductions (tCO ₂) | |
|-------------|--------------------------------|---------------|
| | Annual | Lifetime |
| Chel | 1,358 | 27,152 |
| Las Conchas | 876 | 17,520 |
| Seasir | 576 | 11,512 |
| Jolomijix | 334 | 6,687 |
| | 3,144 | 62,871 |

Assumptions:

- Diesel consumption of 0.74 liters per kWh generated
- CO₂ content of diesel fuel of 2.78 kilograms per liter
- Lifetime of 20 years

285. The use of small-scale hydropower contributes significantly to the sustainable management if watershed area management is introduced as part of the development activities as is proposed under the PURE initiative.
286. The use of solar drying technology in the processing of coffee and cardamom at the four sites would lead to firewood consumption in the drying process of 40%, i.e. a total amount of about 456 m³ annually in the four areas.

Appendix A. LIST OF OFF-GRID HYDROELECTRIC SITES IDENTIFIED BY FUNDACION SOLAR

287. The Table below gives the portfolio of off-grid micro hydropower sites of Fundación Solar that will be included in the PURE in Guatemala project.

| No. | PROJECT | SITE | PHASE | LOCAL ORGANIZATION | COMMUNITIES | DIRECT BENEFICIARIES | | PUE | CAPACITY (MW) |
|-----|------------------------------|---|--|---|---|----------------------|------------|--|---------------|
| | | | | | | FAMILIES | POPULATION | | Off grid |
| 1 | Las Conchas | Aldea Las Conchas, Chahal, Alta Verapaz | Pre-feasibility (feasibility in process) | COCODES | 1. Las Conchas 2. San José 3. San Marcos Chinayú 4. Santa Rita 5. Sechina 6. Sesaltul 7. Setal 8. Porvenir | 303 | 1,498 | Cardamom Wood Bamboo Tourism Pineapple Rice Animal husbandry | 0.190 |
| 2 | Seasir | Aldea Seasir, Cahabón, Alta Verapaz | Pre-feasibility (feasibility in process) | COCODES | 1. China' Asir 2. Seasir 3. Chiis 4. Chiacach 5. Salac I 6. China' ococ | 395 | 2,000 | Coffee Cardamom Wood Pineapple Yucca Vegetables | 0.090 |
| 3 | Jolom Ijix | Aldea, Jolom Ijix, Panzós, Alta Verapaz | Pre-feasibility (feasibility in process) | Asociación de Productores de Cardamomo Orgánico Raxcam (APCOR) y COCODE | 1. Jolom Ijix 4 2. Jalauté Jolom Ijix III 3. Monja Blanca | 86 | 500 | Cardamomo Orgánico Coffee | 0.060 |
| 6 | Sajsiban | Río Ixtupil, | Pre-feasibility | COCODES, Municipality | 1. Ixtupil 2. Sajsiban 3. Santa Marta 4. Ilom 5. Sotzil 6. La perla | 1,431 | 7,150 | Coffee Cardamom | 0.710 |
| 8 | Micro hydro La Vega | La Vega Sipacapa, San Marcos | Profile | Community association; municipality | Aldea la Vega | 95 | 400 | Small industry | 0.060 |
| 9 | Micro hydro Batz' Chicolá | Batz' Chicolá, Nebaj | Profile | Community association; municipality | Batz' Chicolá | 75 | 312 | Coffee Wood | 0.030 |
| 10 | Micro Hydro Lirio Putul | Lirio Putul, Uspantán | Feasibility | Municipal Committee | Lirio Putul | 91 | 357 | Coffee Cardamom Milk products | 0.010 |
| 11 | Micro Hydro Chel | Arroyo Xesai, Chel, Chajul, Quiché | Construction near completion | Asociación Hidroeléctrica Chelense | Chel, Las Flores, Xesai | 440 | 2258 | Coffee Cardamom, Tourism Wood | 0.165 |
| 12 | Micro Hydro Unión 31 de Mayo | Unión 31 de Mayo, Uspantán, Quiché | Construction near completion | Cooperative Unión 31 de Mayo | 8 comunidades integradas en Unión 31 de mayo | 405 | 2308 | Coffee Cardamom Wood; milk products | 0.055 |
| 13 | Micro Hydro Balanyá- | Rincón Grande, Zaragoza, | Profile | Cooperative Rincón Grande | Aldea Rincón Grande | | | Vegetable irrigation Strawberries | 0.055 |

| No. | PROJECT | SITE | PHASE | LOCAL ORGANIZATION | COMMUNITIES | DIRECT BENEFICIARIES | | PUE | CAPACITY (MW) |
|------------|-----------------------|---------------------------------|-------------|---|-----------------|----------------------|------------|---------------------------|---------------|
| | | | | | | FAMILIES | POPULATION | | Off grid |
| | Pixcayá | Chimaltenango | | | | | | for export | |
| 14 | Micro Hydro Guaxabaja | Guaxabajá, Purlhá, Baja Verapaz | Feasibility | Fundación Defensores de la Naturaleza, COCODE | Aldea Guaxabajá | 19 | 188 | Wood Café cardamomo | 0.055 |
| TOTAL (MW) | | | | | | | | | 1.480 |

288. A number of socio-economic criteria were applied for the selection of these MHP sites:

- *Number of households.* The number of households in the area planned to be supplied with electricity should be large enough to allow for some productive uses, processing and services, to safeguard an acceptable load factor of the envisaged capacity of the MHP.
- *Village organization.* Functioning municipality or community councils (COMUDEs or CONCODEs) or associations of villagers exist without major conflicts to ensure that a local organization can run the energy infrastructure, commercialize ‘value added’ products as well as being involved in natural resources management. Synergies can be established with ongoing development initiatives (e.g., investment plans in road infrastructure, natural resource management, agricultural and small business development, health, education).
- *Beneficiaries.* Most villages are located in area prioritized by ZONAPAZ (affected by civil war in the recent past) and/or the Strategy for Poverty Reduction (poor or extremely poor). The inhabitants of these areas predominantly belong to one of the Maya indigenous groups and most households can hardly survive on their agricultural income and are characterized as (extremely) poor. Women will benefit from project activities as much as their male colleagues.
- *Location and market access.* All project areas visited are located at least 10 km from the grid and are not mentioned in the PER (Rural Electrification Plan) to be connected in the near future. However, the hydro potential of the region is highly recognized by the national generation utility INDE (as well as by private sector developers); thus, making the project areas an immediate target for current future project development.
- *Contribution to MPH construction and willingness to pay.* As the communities will be the owners of the MHP, the population is willing to contribute to the planning and construction process of the MHP by cash, material or labor. In future all households are ready to pay according to their energy consumption, in such a way covering all operational, future system repair and maintenance cost by mutually agreed tariffs.
- *Potential to develop the local water resources to generate power.* The water head and year-round water discharge should be such that power can be generated to provide a minimum need amount of power and energy to the community.
- *Potential of productive energy use.* Villagers are aware of the potential of electric equipment for productive use, but value-added opportunities need to be introduced to generate income. The general growth potential of a village or selected area is determined by its agricultural production, by value-adding processing opportunities, by its tourist attractions, by other potential business services and by the purchasing power of its own community.

Appendix B. LIST OF REVIEWED DOCUMENTS

Ecodesa (2006a)

Estudio de Mercado de Servicios Turísticos de la Localidad de Las Conchas

Ecodesa (2006b)

Plan de Negocios de Empresa de Servicios Turísticos de la Localidad de Las Conchas

Ecodesa (2006c)

Estudio de Mercado para Productos de Madera Certificada en la Localidad de Seasir

Ecodesa (2006d)

Plan de Negocios de Productos de Madera Certificada en la Localidad de Seasir

Fundación Solar (2004)

Pico Central Hidroeléctrica Comunidad Jolom Ijix, Fundación Solar (2004), Project PNUD-TTF GUA/03/M20

Fundación Solar (2005)

Iniciativa GVEP Guatemala, Provisión de Servicios Energéticos para la Reducción de la Pobreza en la Franja Transversal del Norte, Project PNUD GUA/04/015

- Chapter 17, *Micro Central Hidroeléctrica, Comunidad Las Conchas*

- Chapter 18, *Micro Central Hidroeléctrica, Seasir*

Fundación Solar (2006a)

Estudio de Mercado y Plan de Negocios para el Uso Productivo Café, Comunidad Jolomijix

Fundación Solar (2006b)

Estudio de Mercado y de Factibilidad para Empresa Beneficiadora y Comercializadora de Cardamomo en Sesair y Chinasis, Fundación Solar (2006)

Fundación Solar (2006c)

Informe Ejecutivo sobre el Proceso de Visibilización del Tema Multiculturalidad en el Proyecto PURE

Fundación Solar (2006d)

Business Plan for the Asociación Hidroeléctrica Chelense

SECTION E. TERMS OF REFERENCE

1. PROJECT BODIES

1.1 Project Management Unit (PMU)

The PMU's function is to manage the PURE project on a day-to-day basis in a flexible manner (see also the text in Section A, paragraph 3.2 of the UNDP project document). The main output of the PMU is to assist Fundación Solar and subcontracted parties under PURE in executing activities and recording the methodology, successes and failures of these components of the overall project.

The chief executive officer of the PMU, the Project Coordinator, provides strategic direction to the PMU and takes ultimate responsibility for the scheduling and quality of all project outputs. The PC has final responsibility for advising and providing all the necessary information on PURE's progress to the PSC on the members of the PMU. The ToR of the PC is a component of the project document included in this Section E).

Apart from the full-time Project Coordinator and part-time International Technical Advisor, other PMU project staff (full-time and part-time) may include: (i) a rural energy infrastructure advisor, (ii) a financial-administrative advisor, (iii) a rural economist, micro-financing and rural credit specialist, (iv) a micro-enterprise and organization specialist, (v) a gender and energy specialist, (vi) a solar/hydro energy specialist, (vii) a specialized hydroelectricity expert, and (viii) bi-lingual Spanish-local languages social workers as well as (viii) core administrative staff (e.g., assistant to the PC, secretary, accounting or other support staff).

In addition, consultants and subcontractors will be contracted to undertake specific project tasks according to the final project schedule, such as institutional development, capacity building, workshop designers and facilitators, hydropower site development etc. Subcontractors may be individuals and/or organizations (that are not in the employment of the project).

1.2 Project Steering Committee (PSC)

The framework of The Global Village Energy Partnership (GVEP), the government of Guatemala (GoG) formed in 2003 a Working Group, originally chaired by the Ministry of Energy and Mines (MEM) and further consisting of the Ministry of Environment and Natural Resources (MARN), Ministry of Food, Livestock and Agriculture (MAGA), Secretary of Economic Planning (SEGEPLAN), Ministry of Economy (MINECO), Ministry of Health and Ministry of Education, and a NGO representative. As of July 2006, SEGEPLAN is the GVEP Focal Point and Coordinator.

PURE will use this existing mechanism of multi-stakeholder coordination's as the *Project Steering Committee* (PSC) providing guidance and supervision on the project implementation., in direct consultation with the Executing Agency (Fundación Solar), the PMU and its Project Director to oversee the smooth running and effective execution of programmatic activities and budgets allocations and to allow for strategic planning, adaptive management and logistical coordination to take place.

DUTIES:

The responsibilities of the PSC include the following:

- Advise and approve the ToRs of PMU staff and subcontracting consultants, to be done jointly with the Project Coordinator;
- Approve the staffing and operational infrastructure of the PMU;
- Approve the contracting of selected consultants/firms to undertake the activities as outlined in the Terms of References mentioned above;

- Approve the annual work plan and progress reports, the first plan being prepared at the outset of the implementation of the project activities;
- Closely follow, for example through reviewing the quarterly and annual reports, the project's implementation progress and recommendations for improvements, if deemed appropriate;
- Act as a platform for sharing information on the project and facilitate the dissemination of information on the project's progress to especially relevant channels within Guatemala.

FREQUENCY AND MEMBERSHIP OF MEETINGS:

The PSC will meet 4 times the first year. In order to coordinate the PURE Project implementation, the GVEP Working Group will be enhanced by incorporating, into its coordination and steering activities, the participation of all participating entities in project, co-financing and implementing, that will be invited to participate in the regular three-monthly meetings. See also Section A of the Project Document, paragraph 3.2.

The PSC may be complemented with external experts as deemed appropriate by the executing agency. During the first meeting of the PSC, the creation of a formal reporting/feedback arrangement will be proposed for the explicit provision of opportunities for a range of industry stakeholders to be involved in the project throughout the various stages of its implementation. This arrangement will have to guarantee full transparency at the national level. The PSC might decide to form an advisory board that could function as a platform to present and share ideas as well as to solicit specific inputs from its members that are envisaged to come from different sections within the rural and energy project development community (academic, finance, consulting engineers, NGO's and project developers/owners).

2. PROJECT MANAGEMENT UNIT

2.1 Project Director

| | |
|-------------------|---|
| TITLE | : Project Director |
| ORGANIZATION | : Project Management Unit (PMU) |
| CONTRACTING PARTY | : Fundación Solar |
| REPORTS TO | : Fundación Solar and Project Steering Committee |
| DURATION | : 106 weeks during 4 years |
| DUTY STATION | : Guatemala City, Guatemala |
| REMUNERATION | : Commensurate with qualifications, skills and experience; about US\$ 225 per day |

RESPONSIBILITIES & DUTIES

- Coordinate the management and implementation of activities as set out in the Project Document;
- Provide support and assistance to the Project Steering Committee
- Provide overall guidance to the Project Coordinator and the Project Management Unit (PMU) for project execution and assist the PMU and consultants in carrying out their assignments
- Act as intermediary between the PMU and Government of Guatemala and coordinate with the ministries involved (e.g., MAGA, MARN, MEM, SEDEPLAN)
- Review and approve ToRs, including consultants and contracted parties
- Review consultants' reports, project budget revisions and all other administrative arrangements as per Fundación Solar and UNDP procedures
- Provide technical assistance in renewable energy policy discussions and development;
- Assist in overall project monitoring and evaluation; and
- Undertake other management duties that contribute to the effective functioning of the project.

REQUIREMENTS

- Senior level official within Fundación Solar
- At least 15 years of experience in operation and management of renewable energy and/or rural development projects in Guatemala

2.2 Project Coordinator

| | |
|-------------------|---|
| TITLE | : Project Coordinator |
| ORGANIZATION | : Project Management Unit (PMU) |
| CONTRACTING PARTY | : Fundación Solar |
| REPORTS TO | : Fundación Solar and Project Steering Committee |
| DURATION | : 106 weeks during 4 years (one-year renewable) |
| DUTY STATION | : Guatemala City, Guatemala |
| REMUNERATION | : Commensurate with qualifications, skills and experience, about US\$ 150 per day |

REQUIREMENTS

Applicants must have post-graduate (at least Master's) training in any one of the following fields of study:

- Development economics with a strong energy systems planning and management component; and/or engineering with energy systems planning focus and/or economics background.
- Work experience with alternative energy technologies, in particular mini/micro hydropower;
- At least ten years experience in the energy field at the household, small-scale commercial, agro-industrial and/or institutional level in public or private sector;
- At least seven years work experience at senior management level with demonstrable project level management skills and ability to coordinate activities involving a large contingent of professional consultants drawn around the country and/or internationally;
- Working knowledge of the Guatemalan energy and rural sector.

RESPONSIBILITIES

Directing activities of the PMU (its ToR is given in Section E of the Project Document):

- Day-to-day management and co-ordination;
- Budgeting;
- Forward planning;
- Liaising with project participants and stakeholders;
- Preparation and presentation of project status reports to the Project Steering Committee;
- Preparing subcontractors terms of reference and contracts;
- Supervision of contracts;
- Technical assistance; and
- Project execution of all tasks identified under the project specified in the Project Document.

DUTIES

- Lead, manage and coordinate the day-to-day management of the PMU to be established at Fundación Solar in Guatemala City, including administration, accounting, technical expertise, and actual project implementation and reporting;
- Lead the development of detailed project design including preparation of subcontractors terms of reference, identification and selection of national, regional and international subcontractors, cost estimation, time scheduling, contracting, and reporting on forward planning of project activities and budget;
- Coordinate activities of consultants and subcontractors including contract management, direction and

supervision of field operations, logistical support, review of technical outputs/reports, measurement /assessment of project achievements and cost control;

- Supervise the selection of the sites, profiling, feasibility analysis and actual installation and follow-up evaluation of renewable energy (mini/micro hydropower) facilities identified in the Project Document;
- Assist in the design, supervision and where possible delivery of the training and outreach activities of the project and take a lead role in the organization of project workshops and dissemination of results of the projects;
- Plan and coordinate various workshops identified in this Project Document;
- Work closely together with the Project Steering Committee (PSC) and UNDP:
 - Allocation of the contribution of GEF and other co-financiers according to the annual work plans and financial reports
 - Preparation of annual work plans, quarterly financial and progress reports and the annual APR (annual project implementation review report)
 - Inform PSC and UNDP on project progress and budget variations and advising on the policy direction at PSC meetings
 - Maintain records/minutes of proceedings of the PSC;
- Take responsibility for the quality and timing of project outputs;
- Assist in overall project monitoring and evaluation; and
- Undertake other management duties that contribute to the effective functioning of the project.

DELIVERABLES

- Finalized Terms of Reference for PMU staff and subcontracting consultants
- Quarterly work plan and financial reports
- Annual progress reports
- Minutes of PSC meetings
- Agenda for project workshops and meetings

2.3 Professional project staff

JOB TITLE: Professional project assistant

PROGRAM AREA: Rural Energy Services

PROJECT: Productive Uses Of Renewable Energy in Guatemala -PURE-

SUPERVISOR: Project Coordinator

BACKGROUND:

The PURE Project falls under the climate change focal area of GEF, in particular its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the framework of Strategic Priorities of GEF, the Project addresses CC-4, 'Productive Uses of Energy'. Also, the integration of watershed management agreements to improve natural resources management aligns the PURE initiative with the Strategic Priority of Adaptation.

The PURE project complements other energy programs and initiatives activities realized by UNDP in Guatemala, incorporating lessons learnt and needs identified during their implementation. These initiatives have opened the political basis and experience which has permitted the organization of the social basis for the administration of energy project at the local level, consolidating the strengthened institutional capacities of communities and local governments. This experience has supported the design of the PURE initiative.

The initiative is linked with other large projects on natural resource management, poverty alleviation and post-war reconstruction.

The fundamental concept is the promotion of renewable energy in communities for productive uses that generate income and improve living standards. This will be achieved by linking the renewable energy potential (in particular hydropower) with rural development efforts and integrating sustainable energy as a fundamental input in productive processes. The project will link local producers with national and global markets. This will generate additional income, thus alleviating poverty in these areas, and provide financial resources to make rural renewable energy projects more sustainable. This is an innovating approach in comparison with traditional efforts that focus on meeting basic energy needs only. In other words, energy is a fundamental input in a rural development framework that catalyzes a value added productive chain.

JOB DESCRIPTION:

General:

The Professional Project Assistant will support the Project Coordinator and be responsible for the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (monitoring and evaluation; social sciences)

Specific functions: According to the activities in PURE

Work relations:

The professional assistant should collaborate closely with the interdisciplinary team of the PURE project and the Project Steering Committee and maintain good relation with the participating target groups.

Responsibilities:

Provide assistance and advice to the Project Coordinator in executing the project's work plan consistent with the project document

Academic level: Professional with specialization and experience according to the areas indicated in the work plan of the PURE project

Experience: At least 5 years of work experience, preferably in multidisciplinary teams
Experience with the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, financial, etc.)

Outputs: The Consultant will assist the Project Coordinator in achieving his/her deliverables

Level of efforts: The consultant will provide professional services and outputs within the timeframe established for the designated tasks

Fee: About US\$ 350-450 per week (US\$ 70-90 per day)

Period: The period will be specified in the contract

3. NATIONAL CONSULTANTS FOR TECHNICAL ASSISTANCE

3.1 Specialized professional consultant I

JOB TITLE: Specialized Professional Consultant I
DURATION: Various positions (total of about 380 person/weeks):
- Electromechanical engineer (30 weeks)
- Civil engineer (30 weeks)
- Electrical engineer (30 weeks)
- Micro-credit expert (60 weeks)
- Lawyer (50 weeks)
- Energy engineer (80 weeks)
- Environmental engineer (100 weeks)

PROGRAM AREA: Rural Energy Services
PROJECT: **Productive Uses Of Renewable Energy in Guatemala -PURE-**
SUPERVISOR: Project Coordinator

BACKGROUND:

The PURE Project falls under the climate change focal area of GEF, in particular its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the framework of Strategic Priorities of GEF, the Project addresses CC -4, 'Productive Uses of Energy'. Also, the integration of watershed management agreements to improve natural resources management aligns the PURE initiative with the Strategic Priority of Adaptation.

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JOB DESCRIPTION:

General:

The Specialized Professional Consultant will be responsible for the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Specific functions: According to the activities in PURE

Work relations:

The Consultant should collaborate closely with the interdisciplinary team of the PURE project and the Project Coordinator and maintain good relation with the participating target groups.

Responsibilities:

The responsibilities will be limited to the specific tasks assigned to the Consultant to achieve the specific results as given in the project document and according to generally accepted norms and standards.

Academic level: Professional with specialization and experience according to the areas indicated in the work plan of the PURE project

Experience: At least 5 years of work experience, preferably in multidisciplinary teams

Experience with the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Outputs: The Consultant will deliver a report or reports containing:

- Realized activities
- Results achieved
- Outputs produced (designs, maps, plans, programs, calculations, evaluations)

Level of efforts: The consultant will provide professional services and outputs within the timeframe established for the designated tasks

Fee: About US\$ 550 per week (US\$ 110 per day)

Period: The period will be specified in the contract

3.2 Specialized professional consultant II

JOB TITLE: Specialized Professional Consultant II
DURATION: Various positions (total of 490 person/weeks):

- Economist (90 weeks)
- Marketing expert (40 weeks)
- Relations expert (30 weeks)
- Sociologist (70 weeks)
- Agronomist (90 weeks)
- Industrial engineer (90 weeks)
- Business administrator (80 weeks)

PROGRAM AREA: Rural Energy Services
PROJECT: **Productive Uses of Renewable Energy in Guatemala -PURE-**
SUPERVISOR: Project Coordinator

BACKGROUND:

The PURE Project falls under the climate change focal area of GEF, in particular its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the framework of Strategic Priorities of GEF, the Project addresses CC-4, 'Productive Uses of Energy'. Also, the integration of watershed management agreements to improve natural resources management aligns the PURE initiative with the Strategic Priority of Adaptation.

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JOB DESCRIPTION:

General:

The National Professional Consultant will be responsible for the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Specific functions: According to the activities in PURE

Work relations:

The Consultant should collaborate closely with the interdisciplinary team of the PURE project and the Project Coordinator and maintain good relation with the participating target groups.

Responsibilities:

The responsibilities will be limited to the specific tasks assigned to the Consultant to achieve the specific results as given in the project document and according to generally accepted norms and standards.

Academic level: Professional with specialization and experience according to the areas indicated in the work plan of the PURE project

Experience: At least 5 years of work experience, preferably in multidisciplinary teams

Experience with the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

| | |
|--------------------------|---|
| Outputs: | The Consultant will deliver a report or reports containing: <ul style="list-style-type: none"> • Realized activities • Results achieved • Outputs produced (designs, maps, plans, programs, calculations, evaluations) |
| Level of efforts: | The consultant will provide professional services and outputs within the timeframe established for the designated tasks |
| Fee: | About US\$ 450 per week (US\$ 90 per day) |
| Period: | The period will be specified in the contract |

3.3 Technical consultants

| | |
|-------------------|---|
| JOB TITLE: | Technical consultant |
| DURATION: | Two positions (total of 130 person/weeks) <ul style="list-style-type: none"> - Electrical technician (80 weeks) - SME specialist (50 weeks) |

PROGRAM AREA: Rural Energy Services

PROJECT: **Productive Uses Of Renewable Energy in Guatemala -PURE-**

SUPERVISOR: Project Coordinator

BACKGROUND:

The PURE Project falls under the climate change focal area of GEF, in particular its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the framework of Strategic Priorities of GEF, the Project addresses CC -4, 'Productive Uses of Energy'. Also, the integration of watershed management agreements to improve natural resources management aligns the PURE initiative with the Strategic Priority of Adaptation.

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JOB DESCRIPTION:

General:

The Technical Consultant will be responsible for the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Specific functions: According to the activities in PURE

Work relations:

The Technical Consultant will collaborate closely with the interdisciplinary team of the PURE project and the Project Coordinator and maintain good relation with the participating target groups.

Responsibilities:

The responsibilities will be limited to the specific tasks assigned to the Consultant to achieve the specific results as given in the project document and according to generally accepted norms and standards.

Academic level: Professional with specialization and experience according to the areas indicated in the work plan of the PURE project

Experience: At least 3 years of work experience, preferably in multidisciplinary teams
Experience in the implementation of activities related to his/her professional technical discipline

Outputs: The Consultant will deliver a report or reports containing:

- Realized activities
- Results achieved
- Outputs produced (workshops, meetings, construction work done, etc.)

Fee: About US\$ 350 per week (US\$ 70 per day)

Period: The period will be specified in the contract

3.4 Field experts

JOB TITLE: Promoter (field expert)

DURATION: Two positions; total of 400 person/weeks

PROGRAM AREA: Rural Energy Services

PROJECT: **Productive Uses Of Renewable Energy in Guatemala -PURE-**

SUPERVISOR: Project Coordinator

BACKGROUND:

The PURE Project falls under the climate change focal area of GEF, in particular its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the framework of Strategic Priorities of GEF, the Project addresses CC-4, 'Productive Uses of Energy'. Also, the integration of watershed management agreements to improve natural resources management aligns the PURE initiative with the Strategic Priority of Adaptation.

The PURE project complements other energy programs and initiatives activities realized by UNDP in Guatemala, incorporating lessons learnt and needs identified during their implementation. These initiatives have opened the political basis and experience which has permitted the organization of the social basis for the administration of energy project at the local level, consolidating the strengthened institutional capacities of communities and local governments. This experience has supported the design of the PURE initiative.

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fundamental input in productive processes. The project will link local producers with national and global markets. This will generate additional income, thus alleviating poverty in these areas, and provide financial resources to make rural renewable energy projects more sustainable. This is an innovating approach in comparison with traditional efforts that focus on meeting basic energy needs only. In other words, energy is a fundamental input in a rural development framework that catalyzes a value added productive chain.

JOB DESCRIPTION:

General:

The Promoter/Field Expert will be bilingual (Spanish and speaking the Mayan language of the target area) and will be responsible for the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Specific functions: According to the activities in PURE

Work relations:

The Promoter/Field Expert should collaborate closely with the interdisciplinary team of the PURE project and the Project Coordinator and maintain good relation with the participating target groups.

Responsibilities:

The responsibilities will be limited to the specific tasks assigned to the Consultant to achieve the specific results as given in the project document and according to generally accepted norms and standards.

Academic level: Professional with specialization and experience according to the areas indicated in the work plan of the PURE project and teaching training on bilingual promotion

Experience: At least 3 years of work experience, preferably in multidisciplinary teams

Experience in the bilingual (Mayan language and Spanish) facilitation of implementing activities related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Outputs: The Consultant will deliver a report or reports containing:

- Realized activities
- Results achieved
- Outputs produced (workshops, meetings, construction work done, etc.)

Level of efforts: Each promoter will provide professional services according to the tasks assigned at the end of the month (200 weeks in total)

Fee: About US\$ 250 per week (US\$ 50 per day)

Period: The period will be specified in the contract

4. NATIONAL CONSULTANTS FOR TECHNICAL ASSISTANCE

4.1 International Technical Advisor

The 'International Technical Advisor' will be needed on a part-time basis for about 32 person/weeks (average of 2 months a year during the project's period)

Responsibilities:

- Providing expertise and advice to the Project Director, Coordinator and the PMU;
- Assisting in the planning of the execution of the work plan;

- Assisting in the elaboration and implementation of the monitoring and evaluation plan (in particular review of the project logical framework; definition and implementation of baseline, case study and impact studies and socio-economic analysis of the mini/micro hydropower and other RE technologies);
- Assist in developing (national) workshops and aid in the identification of international participants and the identification of international expert consultants;
- Assist in drafting ToRs;
- Participate in periodic project progress reviews and project workshops (at least once a year to advice during the preparation of the annual work plan and/or discussion of the plan at the PSC) ;
- Participate in other project-related meetings and provide advisory services (in missions to Guatemala or home-based) on an as-needed basis

Qualifications:

- At least 12 years experience in sustainable energy, of which 5 years in developing countries;
- Experience with international energy and development projects in Latin America and other parts of the world
- Post-graduate degree (M.S.) in engineering (with knowledge of social/economic sciences) or social sciences (with knowledge of renewable energy technologies);
- Must be familiar with issues of RE and PURE development in Guatemala;
- Proven experience with project evaluation (in particular of GEF projects);
- Demonstrable experience in RE project development, in particular UNDP/GEF projects;
- Reading, speaking and writing skills (active and passive) in excellent English and good Spanish

Outputs:

The Consultant will deliver a report or reports containing:

- Realized activities
- Results achieved
- Outputs produced (designs, maps, plans, programs, calculations, evaluations)

Level of efforts:

The consultant will provide professional services and outputs within the timeframe established for the designated tasks

Fee:

About US\$ 600,- per working day

Period:

The period will be specified in the contract

4.2 Specialized international consultants

JOB TITLE:

Specialized International Consultant

DURATION:

Various positions; total of 62 person/weeks

PROGRAM AREA:

Rural Energy Services

PROJECT:

Productive Uses of Renewable Energy in Guatemala -PURE-

SUPERVISOR:

Project Coordinator

BACKGROUND:

The PURE Project falls under the climate change focal area of GEF, in particular its Operational Program 6, 'Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs'. Within the framework of Strategic Priorities of GEF, the Project addresses CC-4, 'Productive Uses of Energy'. Also, the integration of watershed management agreements to improve natural resources management aligns the PURE initiative with the Strategic Priority of Adaptation.

The PURE project complements other energy programs and initiatives activities realized by UNDP in Guatemala, incorporating lessons learnt and needs identified during their implementation. These initiatives have opened the political basis and experience which has permitted the organization of the social basis for

the administration of energy project at the local level, consolidating the strengthened institutional capacities of communities and local governments. This experience has supported the design of the PURE initiative.

The initiative is linked with other large projects on natural resource management, poverty alleviation and post-war reconstruction.

The fundamental concept is the promotion of renewable energy in communities for productive uses that generate income and improve living standards. This will be achieved by linking the renewable energy potential (in particular hydropower) with rural development efforts and integrating sustainable energy as a fundamental input in productive processes. The project will link local producers with national and global markets. This will generate additional income, thus alleviating poverty in these areas, and provide financial resources to make rural renewable energy projects more sustainable. This is an innovating approach in comparison with traditional efforts that focus on meeting basic energy needs only. In other words, energy is a fundamental input in a rural development framework that catalyzes a value added productive chain.

JOB DESCRIPTION:

General:

The Specialized International Consultant will be responsible for the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Specific functions: According to the activities in PURE

Work relations:

The consultant should collaborate closely with the interdisciplinary team of the PURE project and the Project Steering Committee and maintain good relation with the participating target groups.

Responsibilities:

The responsibilities will be limited to the specific tasks assigned to the Consultant to achieve the specific results as given in the project document and according to generally accepted norms and standards.

Academic level: Professional with specialization and experience according to the areas indicated in the work plan of the PURE project

Experience: At least 7 years of work experience, preferably in multidisciplinary teams

Experience with the identification, evaluation, formulation, design, overview and/or supervision of the development of processes related to his/her professional discipline (social, economic, environmental, technological, financial, etc.)

Outputs: The Consultant will deliver a report or reports containing:

- Realized activities
- Results achieved
- Outputs produced (designs, maps, plans, programs, calculations, evaluations)

Level of efforts: The consultant will provide professional services and outputs within the timeframe established for the designated tasks

Fee: About US\$ 500,- per working day

Period: The period will be specified in the contract

2008

| ACTIVITY | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|--|---|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Outcome 1 Development and promotion of 1 .5 MW of off-grid technologies for productive uses of energy (PU E) | | 31 | | | | | | | | | | | |
| 1.1.4 Foster MoUs between community/rural enterprise producers and institutions at the market level | Relations expert | 2-31 | | | | | | | | | | | |
| Output 1.1 Development of 1 .5 MW of off-grid electricity from MHP (and solar) | | | 1 | | | | | | | | | | |
| 1.2.1 Linked with 3.1.4 and 1.3.1, assessment of the state of development in the project area, analysis of potential villages and sites, establishment of a project portfolio of available hydro sites and other RETs and development of specific criteria for selection of RET projects | Sociologist Agronomist Economist Energy engineer Promoters | | 1 | 2 | | | | | | | | | |
| 1.2.2 Selection of project sites and technology, based on consultation with communities, river basin committees (output 3.1), local enterprises, municipalities and/or government | Promoter Promoter Social facilitator Promoters | | | 5 | | | 4 | | | | | | |
| 1.2.3 Development of feasibility studies and financial plans for the proposed subprojects, linked with social and productive uses analysis (as discussed under output 1.1) and environmental impact assessment (linked with output 3.1) | Electromechanical engineer Civil engineer Electric engineer Agronomist Economist Sociologist | | | | | | 5 | | | | | | 5 |
| 1.2.4 Definition and implementation of organizational arrangement of the RET subproject with the river basin committee, local community, cooperative or association, including ownership and management set-up, financial arrangements and tariff structure and stakeholder involvement | Promoters Social facilitator Sociologist Business adm. expert Promoters | | | | | | | | | | | | 6 |

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| 2.1.2 Design of 'good practices' manual, incorporating stakeholder involvement modalities, management and institutional aspects and environmental 'good practices' and distribution of the manual among relevant stakeholders | Business admin. expert Industrial engineer Energy engineer Social facilitator Sociologist | | | | | 4 | | 4 | | | | | |
| 2.1.3 Training in various sessions of small hydropower development practitioners in the technical aspects (design, building and operation), cost-benefit analysis and financial management, ownership and institutional issues, with emphasis on addressing community needs and cultural sensitivities, conflict transformation through stakeholder engagement and environmental aspects | | | | | | | | 5 | | | 4 | | |
| 2.1.4 Identification of 4 sites for grid-connected power to be included in the GEF project | Social facilitator Energy engineer | | | | | 4 | | 4 | | | | | |
| 2.1.5 Development of feasibility studies and business plans, including financial, organization-institutional setup, stakeholder involvement plan and environmental impact assessment | Electromechanical engineer Civil engineer Electric engineer Economist Sociologist | | | | | | | 5 | | | | 5 | |
| 2.1.6 Financial closure for project implementation and MoU between private sector investors and other local or regional partners | Lawyer Social facilitator Sociologist Industrial economist | | | | | | | | | | | 6 | |
| Output 2.2 Productive uses of energy catalyze rural development in communities associated with RE investment | | | 1 | | | | | | | | 4 | | |
| 2.2.1 Assessment of productive uses potential and associated energy needs, including linkages to local, national, and international market studies (similar to activities in Output 1.1). | Economist Sociologist Agronomist | | 1 | 2 | | | | | | | | | |

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| Output 3.1 Increased capital mobilization for PUE lending in the project area | | | | | | | 5 | | | | | | |
| 1.3.1 Assessment of lending opportunities and current capacity of commercial and micro lending organizations | Micro-credit expert Promoters | | | | | | 5 | | 3 | | | | |
| 1.3.2 Development of guidelines on micro -financing methodologies for PUE | Micro-credit expert | | | | | | | | 6-20 | | | | |
| 1.3.3 Training facilitation on lending for PUE for financial institutions and municipality and community members | Micro-credit expert Business adm. expert Facilitator | | | | | | | | 21 | | | 20 | |
| 1.3.4 Identification of financial instruments for energy providers (enterprises, municipality, community), linked with business development and productive uses | Business adm. expert Lawyer Micro-credit expert | | | | | | | | | | | 21 | 20 |
| 1.3.5 Definition and implementation of financial arrangements for PUEs (energy service and productivity improvement) with one or more financial institutions in the area. | Promoters Micro-credit expert Lawyer | | | | | | | | | | | | 21 |
| 1.3.6 Lending funds for productive uses machinery procurement (such as mills, refrigerators for dairy products, food production and processing equipment) as well as for RET procurement, where not covered by the mechanisms included in this project. | Promoters Micro-credit expert | | | | | | | | | | | | 21 |
| Outcome 2 Development of 13.5 MW and promotion of grid -connected private sector RET (small hydro) | | | 1 | | | | | | | | | | |
| Output 2.1 Development of 13.5 MW of hydropower, connected to the grid and to surrounding communities | | | 1 | | | | | | | | | | |
| 2.1.1 Establishment of final project portfolio and pre -feasibility analysis over mini hydropower sites, using already developed project portfolio. | Electromechanical engineer Civil engineer Electrical engineer Economist Sociologist | | 1 | | | 3 | | | | | | | |

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| ACTIVITY | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
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| 2.2.2 Assessment of financing opportunities, including micro financing methodologies, and development of financial arrangements for productive uses of energy (associated with the activities developed under Output 1.3). | Economist Micro-credit expert Promoters Social facilitator | | | | | | | 5 | | 4 | | | |
| 2.2.3 Strengthening of small businesses in beneficiary, mostly indigenous, communities, including capacity building for rural entrepreneurs, development of business and financial plans, and provision of business incubator services (associated with Output 1.4). | Marketing expert Business admin. expert | | | | | | | | | 5 | 4 | | |
| Output 2.3 Stakeholder engagement and implementation of environmental 'good practices' in small hydro project development. | | | | | | | | | | | 5 | | |
| 2.3.1 Training in various sessions of small hydropower development practitioners in the technical aspects (design, building and operation), cost-benefit analysis and financial management, ownership and institutional issues, with emphasis on addressing community needs and cultural sensitivities, conflict transformation through stakeholder engagement and environmental aspects | Energy engineer Industrial engineer Sociologist Social facilitator | | | | | | | | | | 5 | | 5 |
| 2.3.2 Site-specific assessment of stakeholder issues and development of strategy for stakeholder engagement | Lawyer Social facilitator Sociologist | | | | | | | | | | | | 6 |
| Outcome 3 Sustainable natural and energy resources management in river basins | | | | | | | | | | | 5 | | |
| Output 3.1 Local enabling environments for participatory watershed management, integrated with natural resources management for RE generation and vulnerability aspects | | | | | | | | | | | 5 | | |

2008

| ACTIVITY | | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
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| 3.1.1 | Raise awareness among main actors at the institutional level regarding watershed management, climate change adaptation and vulnerability issues, linked with the development of hydropower (and other RETs); dissemination of methodologies and tools on integrated watershed and natural resources management, linked with RE generation and adaptation. | Energy engineer Social facilitator Environmental engineer | | | | | | | | | | 5 | | 5 |
| 3.1.2 | Development of local stakeholder dialogue on issues related to watershed management, vulnerability and climate-related disasters in approximately 15 areas that including the proposed project on-grid and off-grid RE sites. | Social facilitator Sociologist Promoters Relations expert | | | | | | | | | | | | 6 |
| 3.1.3 | Assessment of climate-linked vulnerability, current natural resource management (NRM) practices and local capacities to respond to climate-related emergencies in the 15 micro-river basin areas; | Environmental engineer | | | | | | | | | | 5 | | |
| Outcome 4: Conditions for project replication are established; monitoring, learning and evaluation | | | | | 5 | | | | | | | | | |
| Output 4.1 Monitoring, learning, feedback and evaluation | | | | | 5 | | | | | | | | | |
| 4.1.1 | Establishment of a project performance and impact monitoring tool with indicators and verifiers to gather project-relevant information; M&E | Industrial engineer SME expert M&E expert Energy engineer | | | 5 | | | 4 | | | | | | |
| 4.1.2 | Refinement of project information and documentation on RET and PUE experiences and lessons learnt. Development of case studies on energy, productive uses and income generation, linked with vulnerability and adaptation aspects | Industrial engineer SME expert M&E expert Energy engineer | | | | | | 5 | | | 4 | | | |
| 4.1.3 | Application of IPCC recommendations to estimate carbon sequestration related benefits of the PURE initiative. | Environmental engineer Energy engineer Industrial engineer | | | | | | | | | 5 | 4 | | |
| 4.1.4 | Dissemination of innovative approaches, lessons learned and good practices to local stakeholders and stakeholders at national level | Social facilitator Sociologist Promoters | | | | | | | | | | 5 | | |

2009

| ACTIVITY | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
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| Output 1.1 Development of 1.5 MW of off -grid electricity from MHP and solar | | | | | | | | | | | | | |
| 1.2.4 Definition and implementation of organizational arrangement of the RET subproject with the river basin committee, local community, cooperative or association, including ownership and management set-up, financial arrangements and tariff structure and stakeholder involvement | Promoters Social facilitator Sociologist Business admin. expert | | | 6 | | | | | | | | | |
| 1.2.5 Development of project specifications, contracting and bidding procedures | Engineers Lawyer | | | 7 | 7 | | | | | | | | |
| 1.2.6 Call for bidding, evaluation of bidding and awarding of contracts | Members Lawyer | | | | 8 | 7 | | | | | | | |
| 1.2.7 Construction of RET subprojects at selected sites and communities | Subcontracted constructors | | | | | 8 | | | | | | | |
| Output 1.3 Increased capital mobilization for PUE lending in the project area | | | | | | | | 23 | | | | | |
| 1.3.5 Definition and implementation of financial arrangements for PUEs (energy service and productivity improvement) with one or more financial institutions in the area. | Promoters Micro-credit expert Lawyer | | 20 | | | | | | | | | | |
| 1.3.6 Lending funds for productive uses machinery procurement as well as for RET procurement, where not covered by the mechanisms included in this project. | Promoters Micro-credit expert | | | 21 | | | | | | | | | |
| Outcome 2 Development of 13.5 MW and promotion of grid -connected private sector RET (small hydro) | | | | | | | | | | | | | |
| Output 2.1 Development of 13.5 MW of hydropower, connected to the grid and to surrounding communities | | | | | | | | | | | | | |
| 2.1.6 Financial closure for project implementation and MoU between private sector investors and other local or regional partners | Lawyer Social facilitator Sociologist Financial expert | | 5 | | | | | | | | | | |

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| ACTIVITY | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
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| 2.1.7 Construction of at least 4 projects | Subcontractors | | 6 | | | | | | | | | | |
| Output 2.3 Stakeholder engagement and implementation of environmental 'good practices' in small hydro project development. | | | | | | | | | | | | | 23 |
| 2.3.2 Site-specific assessment of stakeholder issues and development of strategy for stakeholder engagement | Lawyer Social facilitator or Sociologist | | | 6 | | | | | | | | | |
| 2.3.3 Negotiation and enacting of agreement between stakeholders to develop a project, including credit accessibility and technical assistance for PUE access, as well as incentives to attract people around sites being developed to support the project construction. | Lawyer Social facilitator Sociologist Micro-credit expert | | | 7 | | | | 8 | | | | | |
| 2.3.4 Monitoring of the agreements during project implementation | Industrial engineer Evaluation expert | | | | | | | 9 | | | | | 23 |
| Outcome 3 Sustainable natural and energy resources management in river basins | | | | | | | | | | | | | |
| Output 3.1 Local enabling environments for participatory watershed management, integrated with natural resources management for RE generation and vulnerability aspects | | | | | | | | | | 8 | | | |
| 3.1.2 Development of local stakeholder dialogue on issues related to watershed management, vulnerability and climate-related disasters in approximately 15 areas that including the proposed project on -grid and off-grid RE sites. | Social facilitator Sociologist Promoters Relations expert | | | 6 | | | | | | | | | |
| 3.1.3 Assessment of climate -linked vulnerability, current NRM practices and local capacities to respond to climate - related emergencies in the 15 micro -river basin areas | Environmental expert | | | 6 | | | | | | | | | |
| 3.1.4 Identification and organization of local watershed committees in at least 10 out of the 15 sites | Social facilitator Sociologist Promoters | | | 7 | | | 6 | | | | | | |

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| 3.1.5 Assessment of financial schemes to support integrated watershed management practices, including but not limited to "payment for environmental services" schemes | Environmental engineer Economist Industrial engineer | | | | | | 9 | | 7 | | | | |
| 3.1.6 Drafting of integrated river basin plans for natural resources management and disaster response, tailored to local needs and promote participation among both men and women (according to WWF guidelines) | Social facilitator Sociologist Lawyer Environmental engineer | | | | | | | | 8 | 8 | | | |
| Output 3.2 Better management practices for agricultural, agro-forestry, forestry and animal husbandry | | | | 7 | | | | | | | | | |
| 3.2.1 Training/workshops for and dialogue between community, local producers and local NGOs dialogue on sustainable natural resources management, sustainable energy, conflict management techniques and vulnerability reduction; | Social facilitator Environmental engineer Sociologist; Promoters | | | 7 | | | | 8 | | | | | |
| 3.2.2 Implementation of better management agricultural, forestry, agro forestry and animal husbandry practices in at least 15 micro-river basins (including the PURE project's off-grid and on-grid RET sites) | Agronomist Social facilitator Environmental engineer | | | | | | | 9 | | | | | |
| 3.2.3 Monitoring and participatory evaluation of the introduction of better natural resources utilization and agricultural and forestry practices | Social facilitator Industrial engineer | | | | | | | 9 | | | | | 23 |
| Outcome 4: Conditions for project replication are established ; monitoring, learning and evaluation | | | | | | | | | | | | | |
| Output 4.1 Monitoring, learning, feedback and evaluation | | | | | | | | | | 8 | | | |
| 4.1.2 Refinement of project information and dissemination | PMU team | | | | | | | | | | | | |
| 4.1.4 Dissemination of innovative approaches, lessons learnt and good practices to local stakeholders and stakeholders at national level | Social facilitator Sociologist Promoters | | 5 | | | | | | | | | | |

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| 4.1.5 Formulation of a strategy to extend PUE activities in Guatemala after the PURE project ends | M&E expert Social facilitator Sociologist Relations expert | | | | | | 9 | | | 8 | | | |
| Output 4.2 Proposal of regulatory instruments that create an adequate enabling environment for independent small hydropower generation | | | | | | | | | | 9 | | | |
| 4.2.1 Assessment of tariff, regulatory, taxation and legal issues regulatory regarding grid -connected independent power production by the private sector | Lawyer Energy engineer Economist | | | | | | | | | 9 | | 7 | |
| 4.2.2 Policy dialogue between private developers, government and other main stakeholders | National Director M&E expert | | | | | | | | | | | 10 | |

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| ACTIVITY | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
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| Output 1.2 Development of 1 MW of off -grid electricity from mini hydro and solar | | | | | | | | | | | | | |
| 1.2.7 Construction of RET subprojects at selected sites and communities | Subcontractors | | | | | | | | | | | | |
| Output 1.4 Local capacity building and strengthened small and micro enterprises, based on PUE applications | | | | | | 7 | | | | | | | |
| 1.4.1 Formulation of 'good practices' manual for off -grid MHP (and other RE) projects, including design, feasibility and cost analysis, tariff structure, links with productive uses, environmental impact assessment, stakeholder involvements and institutional-organizational aspects as well as containing lessons learnt from other projects | Business admin. expert Industrial engineer Energy engineer Social facilitator | | | | | 7 | | 7 | | | | | |
| 1.4.2 Capacity building program on RETs for PUE for trainers on | Industrial engineers Promoters Electrical engineer Social facilitator | | | | | | | 8 | | | | 6 | |
| 1.4.3 Training and technical support for stakeholders (enterprise, community, municipality and/or individual end user) on: | Promoters Electrical engineer Industrial engineer Social facilitator | | | | | | | | | | | 9 | |
| Output 1.5 Review of technology support system and commercialization of off-grid RETs | | | | | | | | | | | 8 | | |
| 1.5.1 Assessment of the RET support system (maintenance and rural service centers, quality control and codes of practice, RET manufacturers' associations, consultants and support organizations) and commercialization of RETs (marketing, finance, manufacturing and quality control) | Energy engineer Industrial engineer | | | | | | | | | | 8 | | |
| 1.5.2 Identification of capacity gaps in RET support structure and definition and implementation of targeted capacity building program to improve the support system. | Energy engineer Industrial engineer | | | | | | | | | | 8 | | |
| Outcome 2: Development of 13.5 MW and promotion of grid - | | | | | | | | | | | | | |

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| connected private sector RET (small hydro) | | | | | | | | | | | | | | | |
| Output 2.1 Development of 13.5 MW of hydropower, connected to the grid and to surrounding communities | | | | | | | | | | | | | | | |
| 2.1.7 Construction of at least 4 projects | Subcontracted constructors | | | | | | | | | | | | | | |
| Outcome 3 Sustainable natural and energy resources management in river basins | | | | | | | | | | | | | | | |
| Output 3.2 Better management practices for agricultural, agro-forestry, forestry and animal husbandry | | | | | | | | | | | | | | | |
| 3.2.2 Implementation of better management agricultural, forestry, agro forestry and animal husbandry practices in at least 20 micro-river basins (including the PURE project's off-grid and on-grid RET sites) | Agronomist Social facilitator Environmental engineer | | | | | | | | | | | | | | |
| Outcome 4: Conditions for project replication are established, including policy and regulatory proposals, and monitoring and feedback mechanisms. | | | | | | | | | | | | | | | |
| Output 4.1 Monitoring and information dissemination tool for PUE in RET-based rural development and local resources management | | | | | | | | | | | | | | | |
| 4.1.1 Operating PMU | | | | | | | | | | | | | | | |
| 4.1.2 Monitoring and evaluation (mid-term evaluation) | | | | | | | | | | | | | | | |
| Outcome 4: Conditions for project replication are established, including policy and regulatory proposals, and monitoring and feedback mechanisms. | | | | | | | | | | | | | | | |
| Output 4.2 Proposal of regulatory instruments that create an adequate enabling environment | | | | | | | | | | | | 10 | | | |
| 4.2.2 Policy dialogue between private developers, government and other main stakeholders | National Director M&E expert | | | 11 | | | | | | | | | | | |
| 4.2.3 Drafting of proposal for RET -based regulatory approaches and instruments and lobby for approval | Lawyer Energy engineer Economist | | | 12 | 10 | | | | | | | | | | |

2010

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| 4.3.1 Development of basic principles of policy development for off-grid energy supply, linked with existing plans of grid extension | Lawyer Energy engineer Economist National Director Project Coordinator | | | | 13 | | | | | | | | |
| 4.3.2 Assessment of policy instruments related to increased off-grid energy services and rural development, including: <ul style="list-style-type: none"> • 'Smart' subsidy mechanisms and rural energy funds for off-grid energy supply and involving local banks and other credit facilities (promotion of loans and micro-credit, by providing credit guarantee and insurance) • Implementation of efficient financial (non -grant) mechanisms that encourage larger -scale RE employment, involvement of local banks and micro -finance institutions as intermediaries (loans, micro credit, guarantee, insurance) and private sector and community organizations as beneficiaries | Micro-credit expert Economist Business adm. expert Industrial engineer Social facilitator Promoters Sociologist | | | | 13 | | | | | | 14 | | |
| 4.3.3 Formulation of a policy document on sustainable energy and PUE through multi-stakeholder dialogue guided by MEM and organized through the GVEP Steering Committee (see paragraph 3.2) with the participation of, e.g., MARN, MAGA, CONAP, INAB, FIS, CNEE, INDE, EEGSA, Unión Fenosa and URL | Lawyer Energy engineer Economist National Director Project Coordinator | | | | | | | | | | 14 | | 15 |
| Output 4.4 Improved policy dialogue on the linkages between energy supply, rural development, natural resources management and climate -change adaptation | | | | | | | | | | | | | 15 |
| 4.4.1 Preparation of an agenda of policy issues | Lawyer Energy engineer | | | | | | | | | | | | 15 |

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| Outcome 1 Development and promotion of 1.5 MW off-grid technologies for productive uses of energy (PUE) | | | | | | | | | | | | | |
| Output 1.2 Development of 1 MW of off-grid electricity from mini hydro and solar | | | | | | | | | 25 | | | | |
| 1.2.7 Construction of RET subprojects at selected sites and communities | Subcontracted constructors | | | | | | | | 25 | | | | |
| Output 1.4 Local capacity building and strengthened small and micro enterprises, based on PUE applications | | | | | | | | 12 | | | | | |
| 1.4.3 Training and technical support for stakeholders on: <ul style="list-style-type: none"> Operation and maintenance of RETs and on energy enterprise management, based on 'good practices' manual (for private sector, NGOs, ministries, local municipalities and organizations) Productive uses (new product development, micro-enterprise development and management (for fieldworkers from Mayan communities) | Electrical engineer Social facilitator Promoters Industrial engineer | | 8 | | | | | | | | | | |
| 1.4.4 Based on 1.3.1, 1.4.2 and 1.4.3, develop business and financial plans for stimulating businesses involved in PUE development | Marketing expert Economist Business adm. expert | | 9-23 | | | | | | | | | | |
| 1.4.5 Provision of business incubator services for small and micro business, involved in PUE in selected communities and sites | Marketing expert Business adm. expert | | 24 | | | | | 12 | | | | | |
| Outcome 2: Development of 13.5 MW and promotion of grid-connected private sector RET (small hydro) | | | | | | 25 | | | | | | | |
| Output 2.1 Development of 13.5 MW of hydropower, connected to the grid and to surrounding communities | | | | | | 25 | | | | | | | |

2011

| ACTIVITY | RESPONSABLE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AU | SEP | OCT | NOV | DEC |
|--|--|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|
| 2.1.7 Construction of at least 4 projects | Subcontracted constructors | | | | | 25 | | | | | | | |
| Outcome 3 Sustainable natural and energy resources management in river basins | | 19 | | | | | | | | | | | |
| Output 3.2 Better management practices for agricultural, agro-forestry, forestry and animal husbandry | | 19 | | | | | | | | | | | |
| 3.2.2 Implementation of better management agricultural, forestry, agro forestry and animal husbandry practices in about 15 micro-river basins (including the PURE project's off -grid and on-grid RET sites) | Agronomist Social facilitator Environmental expert | 19 | | | | | | | | | | | |
| Outcome 4: Conditions for project replication are established ; monitoring, learning and evaluation | | | | | | | | 19 | | | | | |
| Output 4.1 Monitoring, learning, feedback and evaluation | | | | | | | | 19 | | | | | |
| 4.1.2 Monitoring and evaluation | | | | | | | | | | | | | |
| 4.1.5 Formulation of a strategy to extend PUE activities in Guatemala after the PURE project ends | Team | | | | | | 9 | | | 8 | | | |
| Output 4.4 Improved policy dialogue | | | | | | | | | | | | | |
| 4.4.1 Preparation of an agenda of policy issues | Lawyer Energy engineer | 14 | | | | | | | | | | | |
| 4.4.2 Assessment of a sector -wide approach to rural energy, adaptation, development and donor coordination, to avoid duplication and to effect synergy | Project Coordinator National Director M&E expert Engineer | 14 | | 17 | | | | | | | | | |
| 4.4.3 Convene a multi-stakeholder dialogue on how provision of RETs and off -grid energy services to productive uses can help reduce poverty and enhance environmentally sustai nable development | National Director Project Coordinator | | | 17 | | | | 19 | | | | | |

SECTION G. CAPACITY ASSESSMENT OF FUNDACION SOLAR

5. INTRODUCTION

Fundación Solar is a private development organization that was established under Ministerial Accord No. 302, permitting it to operate with legal entity status in September 2004; however its formal operation began in 1993.

Its Service Lines cover its three Program Areas of

1. Rural energy services
2. Environmental services
3. Integrated water resources management; as well as the fourth line of
4. Planning, monitoring, evaluation and systemization

Relation with focal areas of UNDP

The objectives and the services lines of UNDP are clearly linked with the vision and objectives of Fundación Solar. The Millennium Declaration established in its Goal 1 to eradicate extreme poverty and hunger and Goal 7 focuses on guaranteeing environmental sustainability. Both Goals clearly correspond with efforts undertaken by Fundación Solar. This organization has been established to promote energy services, environmental services, and integrated water resources management, which permits having an impact in the formulation of policies and legislation on water and energy that support sustainable development based on an interdisciplinary, innovative and participatory approach. Fundación Solar seeks to contribute to the building of a society in which individuals can participate in equal conditions and opportunities without differences in gender, class and ethnicity, thus making sustainable development possible.

6. TECHNICAL CAPACITY

6.1 Project administration

According to the Administrative Procedures and Policy Manual of Fundación Solar, the organization works with validated and proven procedures for the design, planning and implementation of projects as well as for the strict financial control of the project's activities.

Fundación Solar has staff that is directly responsible for the elaboration and execution of programs and activities, progress reporting and for the approval of payments and money transfer after the realization of certain project phases or subcontracted services. Every project has a final financial report.

The operations realized by every project are executed in accordance with the guidelines established and required by international cooperation entities under agreement with Fundación Solar. This facilitates the efficient use of resources and a clear focus on goals and objectives.

Fundación Solar has been collaborating with UNDP Guatemala during almost 10 years in which period 4 different projects were executed, based on UNDP standards for project execution. Thus, Fundación Solar has a proven track record of familiarity with the necessary project execution standards.

6.2 Resource allocation

Fundación Solar administers projects whose financial resources are generally provided as a grant or contribution by local institutions that work in the area of sustainable development. Having staff working on each project with technical, legal, administrative and financial expertise ensures the efficient administrative management of project and that a minimum of resources is used to develop each project.

Annually, Fundación Solar administrates and executes some 4 programs and 17 projects with an average total budget of USD 1.5 million per year. On average, an estimated 80% of the funds are spent within the project's original timeframe and of the remaining 20% extensions are applied on a no-cost extension basis.

6.3 Capacity to monitor technical aspects of a project

6.3.1 Development, monitoring and evaluation of projects

Since 2005, Fundación Solar has institutionalized a system of Planning, Monitoring, Evaluation and Systemization (PME&S). Project that are in the investment stage are visited every 3 months, while post-inversion projects are visited every 6 months.

The work plans are given on a trimester basis, in such a way that at least every 3 months activities are realized with the beneficiaries and the subcontractors. According to how activities are being developed and to the nature of services and goods acquired, the PME&S activities can be increased.

Monitoring and evaluation (M&E) involves the active participation of the technical and administrative personnel throughout the project cycle, from the start to the end, at three moments, before, during and ex-post.

In performing M&E, Fundación Solar takes the following criteria into account:

- Establish a base line
- Clearly define the objectives to be evaluated
- Define indicators to measure the results (whether goods or services) and impacts on the beneficiaries and/or the specific eco-region, including gender aspects
- Clearly defined and programmed process to collect and store information for projects and to compile, analyze and disseminate this information
- Feedback of M&E results and impacts into project planning (adaptive management)
- Include costs of M&E as well as of internal audits in the original project budget

6.3.2 Technical and other reports

Technical reports are elaborated as a vehicle for communicating progress and results of particular projects. This is mandatory for subcontractors, the same as institutional partners and donors will require from Fundación Solar.

Fundación requires that the reports will have the following minimum information:

- Analysis of the range of activities that are being realized in the period of reporting, including the expenditures during that period
- Progress reports: for each objective/outcome of the project, indicate what has happened since the beginning or the last reporting period and how this relates with the original targets
- Final reports: evaluation of what has happened during the project's execution period.

7. MANAGEMENT CAPACITY

7.1 Capacity to plan, monitor and coordinate project activities

In accordance with the PME&S system, the planning of projects in Fundación Solar is based on an annual work plan that is revised every 3 months. For the PURE project, the work plan includes an annual meeting between Fundación Solar and UNDP. The Executive Director and the Coordinator of the Rural Energy Services line are responsible for supervising the agreement between UNDP and the Fundación.

Fundación Solar has the necessary infrastructure to achieve project's objectives and outputs based in its head office in Guatemala City. For over 13 years the head office has the necessary office space, staff and logistical and communications equipment (Internet, telephone, radio, etc.). In addition, Fundación Solar has 3 field offices in the provinces of San Marcos, Quiché and Sololá. These field offices will also service PURE's activities.

8. ADMINISTRATIVE CAPACITY

8.1 Objective of administration

The administration has the objective to realize the permanent financial planning, permitting medium and long term operations and the functioning of programs and projects in a financially sustainable way. Administration is responsible for unifying budget formats in such a way they can be subject to clear control mechanisms, for establishing results and impacts indicators that measure the effectiveness and efficiency of initiatives, for designing of a policy that gives incentives staff to manage adequately institutional resources at all levels of the operating structure, and for supervising the interdisciplinary team in charge of the acquisition and subsequent financial negotiation of resources.

8.2 Capacity to obtain goods, services and works in transparent and competitive procedures

Fundación Solar has an organizational setup which permits an adequate institutional functioning and guarantees the effectiveness and efficiency of the services provided. The Contracts and Purchases Manual describes the mandatory norms and standards in the area of purchases and contracts with the aim of securing the best options regarding prices, costing, quality, quantity, delivery times, finance, contracts, services, guarantees, spare parts, etc. for the goods and services to be acquired. For each transaction, terms of reference are made in which all the above-mentioned aspects are indicated.

8.3 Competence to conclude contracts

As an organization legally established in Guatemala, Fundación Solar has legal representatives that can endorse contracts, agreements, letters of intent, etc. The organization has a legal unit that provides juridical advice with respect to all the work areas for initiatives and actions within the framework of the national laws and regulations. Contracts are drafted following the guidelines of donor partners as long as these are not in conflict with the national laws. Generally, contracts are legalized by a notary public, taking into account timeframes, products and amounts (for example, in case of equipment and

infrastructure acquisitions, security money regarding proposals, guarantees and fulfillment of delivery is requested), conflict resolution as well as rights and obligations of both parties.

8.4 Capacity to prepare, authorize and adjust obligations and expenditures

The before-mentioned Contracts and Purchases Manual describes the procedures for the evaluation of proposals, taking into account pricing as well as technical aspects of the offer. For this purpose a tender committee is formed that is in charge of the evaluation of the tender proposals and determines the winner that is awarded the contract with whom the contract is subsequently signed which describes the rights and obligations of each party.

Fundación Solar has a computerized accounting system that allows project cost control and which assigns resources according to the budget structure approved by each donor or partner organization and that allows the periodic evaluation of the budget's balance and profit and loss. The system can produce a range of accounting and budgeting reports in a way that allows flexibility in terms of structure and nomenclature of other organizations' accounting systems.

8.5 Capacity to administrate and maintain equipment

Fixed assets

The fixed assets have insurance policy that protects the goods against fire and theft. The costs were approved the Board of Directors.

Inventories

Inventories consist of office equipment, furniture, vehicles and other equipment (computers, projectors, film equipment, etc.). Each of the goods is identified with an identification code with corresponding nomenclature. All equipment costing more than Q 200, - and with a lifetime beyond 2 years is registered in this way.

The equipment is registered in the in a registry book of Fundación Solar and in its computerized accounting system. The inventory list is checked at least once a year during December and is given to an external auditor.

The goods and articles in the inventories are subject to accounting rules regarding depreciation and replacement.

8.6 Capacity to contract at qualified staff in a transparent and competitive way

Staff hiring policy

Fundación Solar offers job and contracting opportunities with wages and fees that are competitive in the local market:

- The administration of personnel includes recruitment, contracting, compensation, promotion, transfer and training. These processes are open and without discrimination, impartial and without prejudice regarding race, gender, religion or place of origin.
- Fundación Solar provides additional benefits in accordance with the Law, such as salary increases, medical insurance support and sick leave.

Job description

- All the positions of long-term and short-term staff will have a job description that details function and main tasks and requirements and qualifications.

Contracting

The Administrator coordinates with the Legal Advisor the elaboration of the Contract within the framework of the conditions established by the Agreement or Project under which the Contract takes place.

The Contract is a legal instruments applicable in cases where the total amount is Q 10, 000, - or more.

9. FINANCIAL CAPACITY

9.1 Management of funds

The administration assures that no loss of funds or unauthorized uses and transfer takes place, by means of the revision and authorization of the Board of Directors, Executive Director and/or the Coordinator of the Program Area involved.

For the management of joint accounts on member of the Board of Directors will be appointed and 3 members of the technical council.

Each institutional partner and/or project is assigned an account by means of defining cost centers.

Budgets

The budgets are authorized by the institutional partner and the Board of Directors of Fundación Solar and consist of direct and indirect costs with duly assigned cost centers.

The execution of the budgets should be as close as possible to the authorized budget. The Fundación manages an internal budget execution record, which budget and revision is under constant supervision in accordance with the guidelines of the institutional partner during the period of the project.

Fundación Solar has as a policy not to use own funds for the support to activities of projects that are not budgeted.

Costs

Costs are divided in two categories, direct and indirect costs and are registered in 'cost centers':

- 'Direct costs' are those cost directly linked to the project. For example: technical personnel, staff, consultants, travel cost, etc.
- 'Indirect costs' are applied indirectly to a specific project, including costs that are generated by activities that Fundación Solar undertakes to support the project. Examples: office rent, equipment, communications, miscellaneous, taxes and unforeseen costs.
- 'Cost centers' are an accounting tool that allows the effective budget control by means of assigning cost codes to each activity that generate direct or indirect project spending

9.2 Interest gained and project income

- *Bank interest:* If grants are deposited in interest generating accounts, exact control will be realized in accordance with the standards applied by donating partner
- *Income generated by project activities:* Every project activity that generates income will be subject to the restrictions and stipulations of the agreement with the institutional partner

9.3 Frequency of financial and accounting activities

- *Weekly*: revision of daily registered operations and budget statements
- *Biweekly*: carry out payments (expenses, consultancies, providers, contracts, etc.) if properly registered and authorized
- *Monthly*: Budget revision, elaboration of financial statements and reports, cash flow and bank transfers and a of the program of the authorization and application of the following month
- *Monthly, quarterly, half-yearly or annually*: Preparation of internal project budget reports according to the requirements of the institutional partner within the established periods and timeframe
- *Annually*: Preparation of audited financial statements. Preliminary statements are made if need by special controls.

9.4 Budget administration

9.4.1 Internal general budget

The implementation of the internal budget is determined by the specific requirements of each project, regarding consultants, subcontracts, salaries, travel, training, awareness, equipment and miscellaneous and indirect costs.

In the elaboration of the internal budget, the authorized budgets are revised, identifying the activities that activities that will be carried out in subsequent months for each of the ongoing projects.

9.5 Administration of funds

9.5.1 Bank account management

Bank accounts are managed in a controlled and discrete way. A bank account is opened for own funds of the Fundación and grants that are destined for a specific project.

- *Bank statements*. Not later than 15 days after having received the account statements, a 'Bank statement' and other supporting documentation is presented to the Coordinator of the responsible Program Area, who in his/her turn informs the Board of Directors.

9.5.2 Income

- *International transfers of donor organizations*. Funds from donors are received in separate bank accounts for each project
- *Interest*. In case of interest, a special registry is meticulously kept which is reported to the donor and the Board of Directors that both decide what will happen with this income
- *Sale or rental of assets*. Whatever income gained should be used to improve the maintenance or replacement of such equipment
- *Other income* can arrive from e.g., admittance fees from seminars organized by Fundación Solar, training, etc. or reimbursements from third-party accounts

9.5.3 Expenditures

- *Payments for the functioning of Fundación Solar and projects*. Salaries, consultant fees, travel cost, etc. are all duly endorsed by the immediate responsible, the project coordinator and verified by the administration

- *Other payments* include purchase of equipment; advance payments for services, equipment and travel cost, etc.
- *Cash.* Small payments, such as for taxis, parking fees, tips, gardening, garbage collection, etc. are more conveniently paid in cash up to amounts of Q 2,000,-

9.5.4 Account registries and reports

- *Registries* are based on the original assignment of cost centers. These are activated immediately covering revenues and expenditures that are periodically assigned with the help of the 'Integrated Accounting and Banking Program' made in the MS Visual Basic
- *Reports.* Once properly registered, all information about Fundación Solar and projects, technical and administrative reports are shared with the donors in accordance with the requirements and periodicity established between the parties.

10. GENERAL COMMENTS

Fundación Solar has a proven capacity to administratively and technically execute the PURE project in Guatemala. Maybe the largest barrier faced by Fundación Solar in implementing PURE is posed by the political context. The renewable energy and rural economic development are just some of the many priorities in the Government's national agenda, also because many of the participating groups may not be adequately represented. PURE attempts to tackle this limitation by establishing the broad 'Project Steering and Coordinating Committee'. The Committee will provide strategic, institutional and policy supports to the project activities and facilitate the linking of local actions with national processes and policies that permit the replicability of the project and the sustainability of the initiatives.

On the operational level, the field offices of Fundación Solar with are fundamental for the project's success. Strengthening both the head and the field offices with new staff and supporting existing staff will be necessary to guarantee the success of PURE. Therefore, Fundación Solar own budget will be increased in addition to the funds made available for PURE.

SECTION H. PROJECT COOPERATION AGREEMENT BETWEEN UNDP AND FUNDACION SOLAR

PROJECT COOPERATION AGREEMENT between THE UNITED NATIONS DEVELOPMENT PROGRAMME and FUNDACION SOLAR

Whereas the United Nations Development Programme ("UNDP") and Fundacion Solar ("the NGO") have, on the basis of their respective mandates, a common aim in the furtherance of sustainable human development;

Whereas UNDP has been entrusted by its donors with certain resources that can be allocated for programmes and projects, and is accountable to its donors and to its Executive Board for the proper management of these funds and can, in accordance with the UNDP Financial Regulations and Rules, make available such resources for cooperation in the form of a Project;

Whereas the NGO, its status being in accordance with national regulations, is committed to the principles of participatory sustainable human development and development cooperation, has demonstrated the capacity needed for the activities involved, in accordance with the UNDP requirements for management; is apolitical and not profit-making;

Whereas the NGO and UNDP agree that activities shall be undertaken without discrimination, direct or indirect, because of race, ethnicity, religion or creed, status of nationality or political belief, gender, handicapped status, or any other circumstances;

Now, therefore, on the basis of mutual trust and in the spirit of friendly cooperation, the NGO and UNDP have entered into the present Agreement.

Article I. Definitions

For the purpose of the present Agreement, the following definitions shall apply:

- (a) "Parties" shall mean the NGO and UNDP;
- (b) "UNDP" shall mean the United Nations Development Programme, a subsidiary organ of the United Nations, established by the General Assembly of the United Nations;
- (c) "The NGO" shall mean Fundacion Solar, a non-governmental organization that was established in 1994 with headquarters in Guatemala and with a mission to establish ourselves as a driving force in the fields of renewable energy services, environmental services, legislation and policy formulation for water and energy, to support sustainable development integrating an innovative, participatory and interdisciplinary focus and the Vision to contribute to the construction of a society in which people participate with equal conditions and opportunities, without distinction of gender, class or ethnic background, thus enabling sustainable development.

(d) "The Agreement" or "the present Agreement" shall mean the present Project Cooperation Agreement and the Project Document, to which the present project cooperation agreement is attached as Section I;

(e) "Project" shall mean the activities as described in the Project Document;

(f) "Government" shall mean the Government of Guatemala

(g) "UNDP resident representative" shall mean the UNDP official in charge of the UNDP office in the country, or the person acting on his/her behalf;

(h) "Project Director" shall mean the person appointed by the NGO, in consultation with UNDP and with the approval of the Government coordinating authority, who acts as the overall coordinator of the Project and assumes the primary responsibility for all aspects of it;

(i) "Expenditure" shall mean the sum of disbursements made and valid outstanding obligations incurred in respect of goods and services rendered;

(j) "To advance" shall mean a transfer of assets, including a payment of cash or a transfer of supplies, the accounting of which must be rendered by the NGO at a later date, as herein agreed upon between the Parties;

(k) "Income" shall mean the interest on the Project funds and all revenue derived from the use or sale of capital equipment, and from items purchased with funds provided by UNDP or from revenues generated from Project outputs;

(l) "Force majeure" shall mean acts of nature, war (whether declared or not), invasion, revolution, insurrection, or other acts of a similar nature or force;

(m) "Project Work Plan" shall mean a schedule of activities, with corresponding time frames and responsibilities, that is based upon the Project Document, deemed necessary to achieve Project results, prepared at the time of approval of the Project, and revised annually.

(n) "Project Budget" shall mean the budget set forth in the Project Document.

Article II. Objective and Scope of the Present Agreement

1. The present Agreement sets forth the general terms and conditions of the cooperation between the Parties in all aspects of achieving the Project Objectives, as set out in the Project Document (Annex of the present Agreement).

2. The Parties agree to join efforts and to maintain close working relationships, in order to achieve the Objectives of the Project.

Article III. Duration of Project Agreement

1. The term of the present Agreement shall commence on December 1st. 2006 and terminate on November 31st 2010. The Project shall commence and be completed in accordance with the time-frame or schedule set out in the Project Document.

2. Should it become evident to either Party during the implementation of the Project that an extension beyond the expiration date set out in paragraph 1, above, of the present Article, will be necessary to achieve the Objectives of the Project, that Party shall, without delay, inform the other Party, with a view to entering into consultations to agree on a new termination date. Upon agreement on a termination date, the Parties shall conclude an amendment to this effect, in accordance with Article XVII, below.

Article IV. General Responsibilities of the Parties

1. The Parties agree to carry out their respective responsibilities in accordance with the provisions of the present Agreement, and to undertake the Project in accordance with UNDP policies and procedures as set out in the UNDP Programming Manual, which forms an integral part of the present Agreement.

2. Each Party shall determine and communicate to the other Party the person (or unit) having the ultimate authority and responsibility for the Project on its behalf. The Project Director shall be appointed by the NGO, in consultation with UNDP and with the approval of the government coordinating authority.

3. The Parties shall keep each other informed of all activities pertaining to the Project and shall consult once every three months or as circumstances arise that may have a bearing on the status of either Party in the country or that may affect the achievement of the Objectives of the Project, with a view to reviewing the Work Plan and Budget of the Project.

4. The Parties shall cooperate with each other in obtaining any licenses and permits required by national laws, where appropriate and necessary for the achievement of the Objectives of the Project. The parties shall also cooperate in the preparation of any reports, statements or disclosures, which are required by national law.

5. The NGO may use the name and emblem of the United Nations or UNDP only in direct connection with the Project, and subject to prior written consent of the UNDP Resident Representative in Guatemala.

6. The activities under the present Agreement are in support of the efforts of the Government, and therefore the NGO will communicate with the Government as necessary. The Project Director will be responsible for day-to-day contacts with the relevant national authorities and UNDP on operational matters during the implementation of the Project. The UNDP Resident Representative will act as the principal channel for communicating with the Government coordinating authority regarding the activities under the Project Cooperation Agreement unless otherwise agreed with the Parties and the Government.

7. The UNDP Resident Representative will facilitate access to information, advisory services, technical and professional support available to UNDP and will assist the NGO to access the advisory services of other United Nations organizations, whenever necessary.

8. The Parties shall cooperate in any public relations or publicity exercises, when the UNDP Resident Representative deems these appropriate or useful.

Article V. Personnel Requirements

1. The NGO shall be fully responsible for all services performed by its personnel, agents, employees, or contractors (hereinafter referred to as "Personnel").

2. The NGO personnel shall not be considered in any respect as being the employees or agents of UNDP. The NGO shall ensure that all relevant national labor laws are observed.

3. UNDP does not accept any liability for claims arising out of the activities performed under the present Agreement, or any claims for death, bodily injury, disability, damage to property or other hazards that may be suffered by NGO personnel as a result of their work pertaining to the project. It is understood that adequate medical and life insurance for NGO personnel, as well as insurance coverage for service-incurred illness, injury, disability or death, is the responsibility of the NGO.

4. The NGO shall ensure that its personnel meet the highest standards of qualification and technical and professional competence necessary for the achievement of the Objectives of the Project, and that decisions on employment related to the Project shall be free of discrimination on the basis of race, religion or creed, ethnicity or national origin, gender, handicapped status, or other similar factors. The NGO shall ensure that all personnel are free from any conflicts of interest relative to the Project Activities.

Article VI. Terms and Obligations of Personnel

The NGO undertakes to be bound by the terms and obligations specified below, and shall accordingly ensure that the personnel performing project-related activities under the present Agreement comply with these obligations:

(a) The personnel shall be under the direct charge of the NGO, which functions under the general guidance of UNDP and the Government;

(b) Further to subparagraph (a) above, they shall not seek nor accept instructions regarding the activities under the present Agreement from any Government other than the Government of Guatemala or other authority external to UNDP;

(c) They shall refrain from any conduct that would adversely reflect on the United Nations and shall not engage in any activity, which is incompatible with the aims and objectives of the United Nations or the mandate of UNDP;

(d) Subject to the requirements outlined in the document "UNDP public information disclosure policy", information that is considered confidential shall not be used without the authorization of UNDP. In any event, such information shall not be used for individual profit. The Project Director may communicate with the media regarding the methods and scientific procedures used by the NGO; however, UNDP clearance is required for the use of the name UNDP in conjunction with Project Activities in accordance with Article IV, paragraph 5, above. This obligation shall not lapse upon termination of the present Agreement unless otherwise agreed between the Parties.

Article VII. Supplies, Vehicles and Procurement

1. UNDP shall contribute to the Project the resources indicated in the Budget section of the Project Document.

2. Equipment, non-expendable materials, or other property furnished or financed by UNDP shall remain the property of UNDP and shall be transferred to the NGO upon completion of the Project or upon termination of the present Agreement, unless otherwise agreed upon between the Parties, and in consultation with the government coordinating authority. During Project

implementation and prior to such transfer, the NGO shall be responsible for the proper custody, maintenance and care of all equipment. The NGO shall, for the protection of such equipment and materials during implementation of the Project, obtain appropriate insurance in such amounts as may be agreed upon between the Parties and incorporated in the Project Budget.

3. The NGO will place on the supplies, equipment and other materials it furnishes or finances such markings as will be necessary to identify them as being provided by UNDP.

4. In cases of damage, theft or other losses of vehicles and other property made available to the NGO, the NGO shall provide UNDP with a comprehensive report, including police report, where appropriate, and any other evidence giving full details of the events leading to the loss of the property.

5. In its procedures for procurement of goods, services or other requirements with funds made available by UNDP as provided for in the Project Budget, the NGO shall ensure that, when placing orders or awarding contracts, it will safeguard the principles of highest quality, economy and efficiency, and that the placing of such orders will be based on an assessment of competitive quotations, bids, or proposals unless otherwise agreed to by UNDP.

6. UNDP shall make every effort to assist the NGO in clearing all equipment and supplies through customs at places of entry into the country where Project activities are to take place.

7. The NGO shall maintain complete and accurate records of equipment, supplies and other property purchased with UNDP funds and shall take periodic physical inventories. The NGO shall provide UNDP annually with the inventory of such equipment, property and non-expendable materials and supplies, and at such time and in such form as UNDP may request.

Article VIII. Financial and Operational Arrangements

1. In accordance with the Project Budget, UNDP has allocated and will make available to the NGO funds up to the maximum amount of US\$ 2,650,000. The first installment will be advanced to the NGO within 10 working days following signature of the present Agreement. The second and subsequent installments will be advanced to the NGO quarterly, when a financial report and other agreed-upon documentation, as referenced in Article X, below, for the activities completed have been submitted to and accepted by UNDP as showing satisfactory management and use of UNDP resources.

2. The NGO agrees to utilize the funds and any supplies and equipment provided by UNDP in strict accordance with the Project Document. The NGO shall be authorized to make variations not exceeding 20 per cent on any one line item of the Project Budget provided that the total Budget allocated by UNDP is not exceeded. The NGO shall notify UNDP about any expected variations on the occasion of the quarterly consultations set forth in Article IV, paragraph 3, above. Any variations exceeding 20 per cent on any one- line item that may be necessary for the proper and successful implementation of the Project shall be subject to prior consultations with and approval by UNDP.

3. The NGO further agrees to return within two weeks any unused supplies made available by UNDP at the termination or end of the present Agreement or the completion of the Project. Any unspent funds shall be returned within two months of the termination of the present Agreement or the completion of the Project.

4. UNDP shall not be liable for the payment of any expenses, fees, tolls or any other financial cost not outlined in the Project Work Plan or Project Budget unless UNDP has explicitly agreed in writing to do so prior to the expenditure by the NGO.

Article IX. Maintenance of Records

1. The NGO shall keep accurate and up-to-date records and documents in respect of all expenditures incurred with the funds made available by UNDP to ensure that all expenditures are in conformity with the provisions of the Project Work Plan and Project Budget. For each disbursement, proper supporting documentation shall be maintained, including original invoices, bills, and receipts pertinent to the transaction. Any Income, as defined in Article I, paragraph 1 (k), above, arising from the management of the Project shall be promptly disclosed to UNDP. The Income shall be reflected in a revised Project Budget and Work Plan and recorded as accrued income to UNDP unless otherwise agreed between the Parties.

2. Upon completion of the Project/or Termination of the Agreement, the NGO shall maintain the records for a period of at least four years unless otherwise agreed upon between the Parties.

Article X. Reporting Requirements

1. The NGO shall provide UNDP and the government coordinating authority with periodic reports on the progress, activities, achievements and results of the Project, as agreed between the Parties. As a minimum, the NGO shall prepare an annual progress report.

2. Financial reporting will be quarterly:

(a) The NGO prepares a financial report and submits it to the UNDP Resident Representative no later than 15 days after the end of each quarter, in Spanish.

(b) The purpose of the financial report is to request a quarterly advance of funds, to list the disbursements incurred on the Project by budgetary component on a quarterly basis, and to reconcile outstanding advances and foreign exchange loss or gain during the quarter.

(c) The financial report has been designed to reflect the transactions of a project on a cash basis. For this reason, unliquidated obligations or commitments should not be reported to UNDP, i.e., the reports should be prepared on a "cash basis", not on an accrual basis, and thus will include only disbursements made by the NGO and not commitments. However, the NGO shall provide an indication when submitting reports as to the level of unliquidated obligations or commitments, for budgetary purposes;

(d) The financial report contains information that forms the basis of a periodic financial review and its timely submission is a prerequisite to the continuing funding of the Project. Unless the Financial Report is received, the UNDP Resident Representative will not act upon requests for advances of funds from UNDP;

(e) Any refund received by an NGO from a supplier should be reflected on the financial report as a reduction of disbursements on the component to which it relates.

3. Within two months of the completion of the Project or of the termination of the present Agreement, the NGO shall submit a final report on the Project activities and include a final financial report on the use of UNDP funds, as well as an inventory of supplies and equipment.

Article XI. Audit Requirements

1. The NGO shall submit to the UNDP Resident Representative in Guatemala a certified annual financial statement on the status of funds advanced by UNDP. The Project will be audited at least once during its lifetime but may be audited annually, as will be reflected in the annual audit plan prepared by UNDP Headquarters (Division of Audit and Performance Review) in consultation with the Parties to the Project. The audit shall be carried out by the auditors of the NGO or by a qualified audit firm, which will produce an audit report and certify the financial statement.

2. Notwithstanding the above, UNDP shall have the right, at its own expense, to audit or review such Project-related books and records as it may require and to have access to the books and record of the NGO, as necessary.

Article XII. Responsibility for Claims

1. The NGO shall indemnify, hold and save harmless, and defend at its own expense, UNDP, its officials and persons performing services for UNDP, from and against all suits, claims, demands and liability of any nature and kind, including their cost and expenses, arising out of the acts or omissions of the NGO or its employees or persons hired for the management of the present Agreement and the Project.

2. The NGO shall be responsible for, and deal with all claims brought against it by its Personnel, employees, agents or subcontractors.

Article XIII. Suspension and Early Termination

1. The Parties hereto recognize that the successful completion and accomplishment of the purposes of a technical cooperation activity are of paramount importance, and that UNDP may find it necessary to terminate the Project, or to modify the arrangements for the management of a Project, should circumstances arise that jeopardize successful completion or the accomplishment of the purposes of the Project. The provisions of the present Article shall apply to any such situation.

2. UNDP shall consult with the NGO if any circumstances arise that, in the judgment of UNDP, interfere or threaten to interfere with the successful completion of the Project or the accomplishment of its purposes. The NGO shall promptly inform UNDP of any such circumstances that might come to its attention. The Parties shall cooperate towards the rectification or elimination of the circumstances in question and shall exert all reasonable efforts to that end, including prompt corrective steps by the NGO, where such circumstances are attributable to it or within its responsibility or control. The Parties shall also cooperate in assessing the consequences of possible termination of the Project on the beneficiaries of the Project.

3. UNDP may at any time after occurrence of the circumstances in question, and after appropriate consultations, suspend the Project by written notice to the NGO, without prejudice to the initiation or continuation of any of the measures envisaged in paragraph 2, above, of the present Article. UNDP may indicate to the NGO the conditions under which it is prepared to authorize management of the Project to resume.

4. If the cause of suspension is not rectified or eliminated within 14 days after UNDP has given notice of suspension to the NGO, UNDP may, by written notice at any time thereafter during the continuation of such cause: (a) terminate the Project; or (b) terminate the management of the Project by the NGO, and entrust its management to another institution. The effective date of termination under the provisions of the present paragraph shall be specified by written notice from UNDP.

5. Subject to paragraph 4 (b), above, of the present Article, the NGO may terminate the present Agreement in cases where a condition has arisen that impedes the NGO from successfully fulfilling its responsibilities under the present Agreement, by providing UNDP with written notice of its intention to terminate the present Agreement at least 30 days prior to the effective date of termination if the Project has a duration of up to six months and at least 60 days prior to the effective date of termination if the Project has a duration of six months or more.

6. The NGO may terminate the present Agreement only under point 5, above, of the present Article, after consultations have been held between the NGO and UNDP, with a view to eliminating the impediment, and shall give due consideration to proposals made by UNDP in this respect.

7. Upon receipt of a notice of termination by either Party under the present Article, the Parties shall take immediate steps to terminate activities under the present Agreement, in a prompt and orderly manner, so as to minimize losses and further expenditures. The NGO shall undertake no forward commitments hereunder and shall return to UNDP, within 30 days, all unspent funds, supplies and other property provided by UNDP unless UNDP has agreed otherwise in writing.

8. In the event of any termination by either Party under the present Article, UNDP shall reimburse the NGO only for the costs incurred to manage the project in conformity with the express terms of the present Agreement. Reimbursements to the NGO under this provision, when added to amounts previously remitted to it by UNDP in respect of the Project, shall not exceed the total UNDP allocation for the Project.

9. In the event of transfer of the responsibilities of the NGO for the management of a Project to another institution, the NGO shall cooperate with UNDP and the other institution in the orderly transfer of such responsibilities.

Article XIV. Force majeure

1. In the event of and as soon as possible after the occurrence of any cause constituting Force majeure, as defined in Article I, paragraph 1, above, the Party affected by the Force majeure shall give the other Party notice and full particulars in writing of such occurrence if the affected Party is thereby rendered unable, in whole or in part, to perform its obligations or meet its responsibilities under the present Agreement. The Parties shall consult on the appropriate action to be taken, which may include suspension of the present Agreement by UNDP, in accordance with Article XIII, paragraph 3, above, or termination of the Agreement, with either Party giving to the other at least seven days written notice of such termination.

2. In the event that the present Agreement is terminated owing to causes constituting Force Majeure, the provisions of Article XIII, paragraphs 8 and 9, above, shall apply.

Article XV. Arbitration

The Parties shall try to settle amicably through direct negotiations, any dispute, controversy or claim arising out of or relating to the present Agreement, including breach and termination of the Agreement. If these negotiations are unsuccessful, the matter shall be referred to arbitration in accordance with United Nations Commission on International Trade Law Arbitration Rules. The Parties shall be bound by the arbitration award rendered in accordance with such arbitration, as the final decision on any such dispute, controversy or claim.

Article XVI. Privileges and Immunities

Nothing in or relating to the present Agreement shall be deemed a waiver, express or implied, of any of the privileges and immunities of the United Nations and UNDP.

Article XVII. Amendments

The present Agreement or its Annexes may be modified or amended only by written agreement between the Parties.

IN WITNESS WHEREOF, the undersigned, being duly authorized thereto, have on behalf of the Parties hereto signed the present Agreement at the place and on the day below written.

For the NGO:

For UNDP:

Signature: _____

Signature: _____

Name: Ivan Azurdia-Bravo

Name: Beat Rohr

Title: Executive Director

Title: Resident Representative.

Place: Guatemala

Place: Guatemala

Date: _____

Date: _____

SIGNATURE PAGE

Country: **Guatemala**

UNDAF Outcome(s)/Indicator(s):

A more sustainable and diversified production as a framework on economic and social public policies that will generate a greater number of opportunities with respect to labor norms and that promotes a sustainable, inclusive and equal economic growth.

Expected Outcome(s)/Indicator (s):

1.1 Greater incorporation of the principles of human development, population, environmental sustainability and human rights, in national debates and in public policies.

Implementing partner:
(designated institution/Executing agency)

Fundación Solar

Programme Period: 2005-2008
Programme Component: Poverty Reduction
Project Title: **Productive Uses of Renewable Energy in Guatemala (PURE) PIMS No. 3186**
ATLAS Project: 00051216
ATLAS Proposal: 00043790
Project Duration: 5 years
Management Arrangement: *NGO Executed*

Total budget: **14,050,000**

Allocated resources:

- Government 9,325,000
- Other:
 - GEF 2,550,000
 - Private 1,000,000
 - Others 1,000,000

In kind contributions

- NGO 175,000

Agreed by UNDP: _____

date: _____

06/08/2007

Agreed by Government: _____

date: _____

02/08/2007

Agreed by Fundación Solar: _____

date: _____

02/08/2007