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1. **Summary**
2. **Situation analysis and framework conditions**
- 2.1 **Energy situation especially in rural areas**

2.1.1 Energy demand and supply in the household sector¹

The total primary energy offer in Honduras is around 3,020 kTEP or 35,110 GWh. The main source of primary energy is petroleum with 50% share followed by firewood (34 %), hydropower (6 %) and other biomass (6.5 %).

The residential share of energy consumption is around 42% of which 87% are provided by fuel wood.

Gross electricity generation of the national grid (Sistema Interconectado Nacional –SIN) is currently around 5,959 GWh, with the share of 63.3 % petrol power plants, 34.7 % hydro power, 1.7 % Biomass (bagasse) and 0.3 % imports. The net electricity offer is around 4,430 GWh including imports and exports. Consequently, 25,2% of the gross electricity production is lost. The losses are the highest in Central America after Nicaragua and for 60% classified as non-technical. Following a recent study on the financial crisis of the state owned electricity company ENEE, the non technical losses are caused for about 40 % of fraud, 30 % of illegal connections in marginalised settlements and for 30 % of errors in the billing. While the illegal connection make up for 77% of the non technical losses caused by the residential sector (in total 39%), the fraud and billing errors occur especially in the commercial and industrial sector (50 % of the non technical losses).²

The installed effective capacity increased from 565 MW in 1994 to 1158 MW in 2006 (with a nominal capacity of 1547 MW) while the peak demand increased from 453 MW to 1088 MW in the same period. As the demand is rapidly increasing a deficit for the period 2007-2010 of 170-380 MW is expected, which has to be covered by imports and emergency diesel power plants.

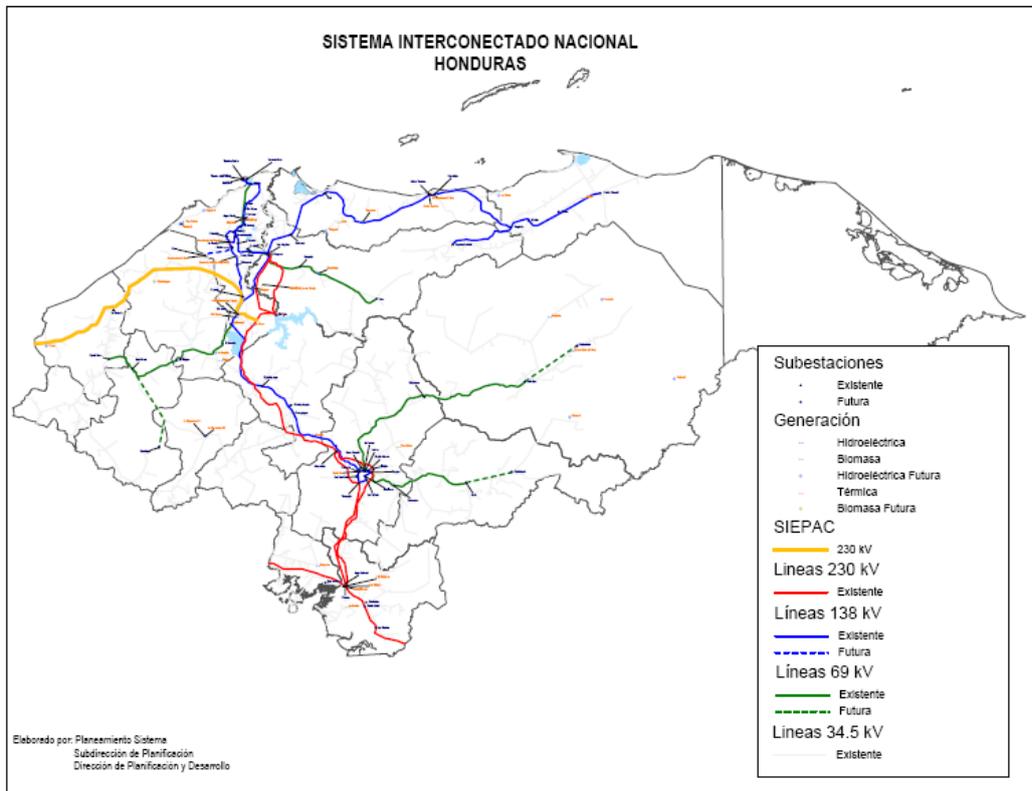
2.1.2 Rural electricity supply

Honduras has one of the lowest rural electrification rates in Latin America after Nicaragua. About 55 percent of the rural population (31% nationally) still lacks access to electricity. In absolute terms, it is estimated that a total of about 417,000 households in rural areas remain unserved. The national electricity system is concentrated oin the western part of Honduras while the sparsely populated eastern part remains mainly beyond economic line-extension distances. (see figures below).

¹ Source: ENEE Estadísticas 2005, ENEE Boletín Estadístico Marzo 2007, SERNA/DGE Diagnóstico del sector energético Hondureño 2003.

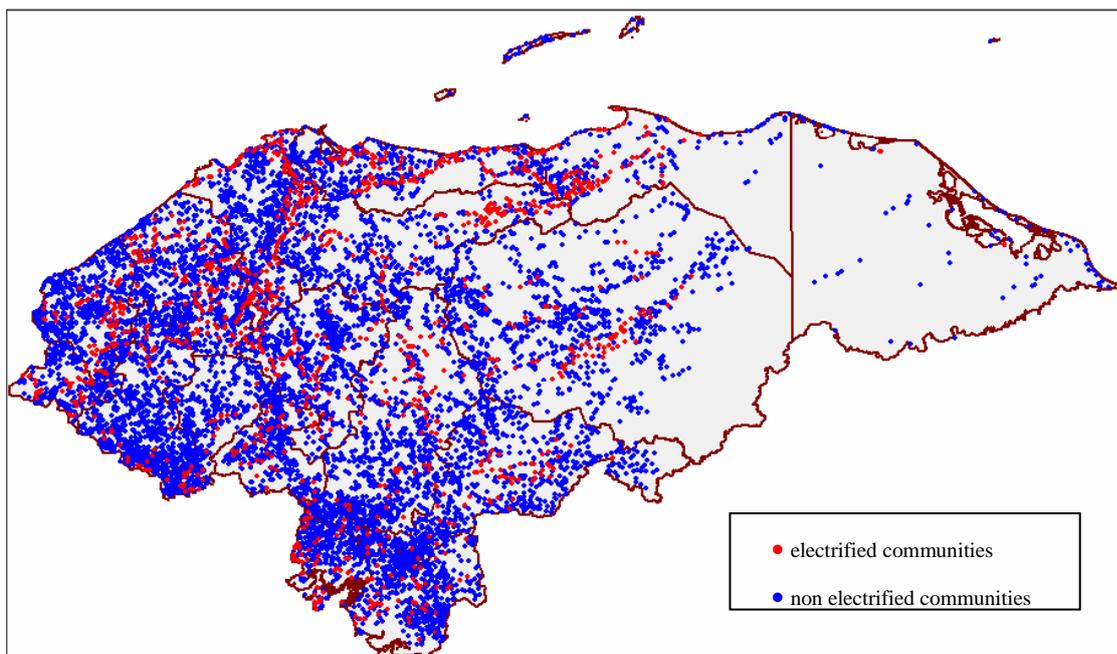
² HONDURAS - Temas y Opciones del Sector Energía, Informe Final, Asociación de Desarrollo Internacional (ADI), April 2007.

The national electricity transmission lines



Source: ENEE

Communities connected to the national grid or mini grids



Source: OES/FOSODE

The population density in Honduras is about 58 inhabitants per square kilometre. While in the western departments the density reaches proportions of 137 Inhabitants per km² (Franzisko Morazan) and 306 Inhabitants per km² (Cortez) in the eastern part it declines to 17.5 (Olancho) and 4 (Gracias a Dios - Moskitia)³. In Rural areas population is highly dispersed and access is often difficult (for example, there is only river access to most of the Moskitia Region). These two characteristics prevent provision of electric services by the conventional grid, and call for site-specific off-grid solutions like the diesel plants, solar or hydropower.

Off-grid electrification in Honduras today consists mainly of installing diesel minigrids, operated by independent companies to serve some larger villages on the bay islands (Roatán Electric Company” RECO, “Utila Power Company” UPCO, “Bonaca Electric Company” BELCO) and in Puerto Lempira in the department Gracias a Díos (INELEM and ELESA). In a few cases hydroelectric and solar home systems have been implemented.

2.2 Institutional set up and actors in the energy sector

Honduras's power sector started a deep restructuring in 1994, when it was decided to unbundle the generation, transmission and distribution divisions of the state-owned Empresa Nacional de Energía Eléctrica (ENEE). However, only the generation has been opened for private producers while ENEE buys all electricity via long term power purchase contracts and manages the national transmission system (SIN) and the distribution. Since 2000 ENEE faces a deep financial crisis and since 2005 the discussion on finally unbundling ENEE have intensified.

2.2.1 Public institutions

Energy policy in Honduras remains highly disorganised with many different institutions involved without a clear separation of responsibilities and tasks. The main conflict lies in the fact that the Ministry for Natural Resources and Environment (Secretaría de Recursos Naturales y Ambiente - SERNA) through its subsection Dirección General de Energía (DGE) has the formal responsibility while the national electricity utility Empresa Nacional de Energía Eléctrica (ENEE) whose director takes up the rank as minister of the government as well is de facto more powerful and keeps the control of all the activities connected to the SIN.

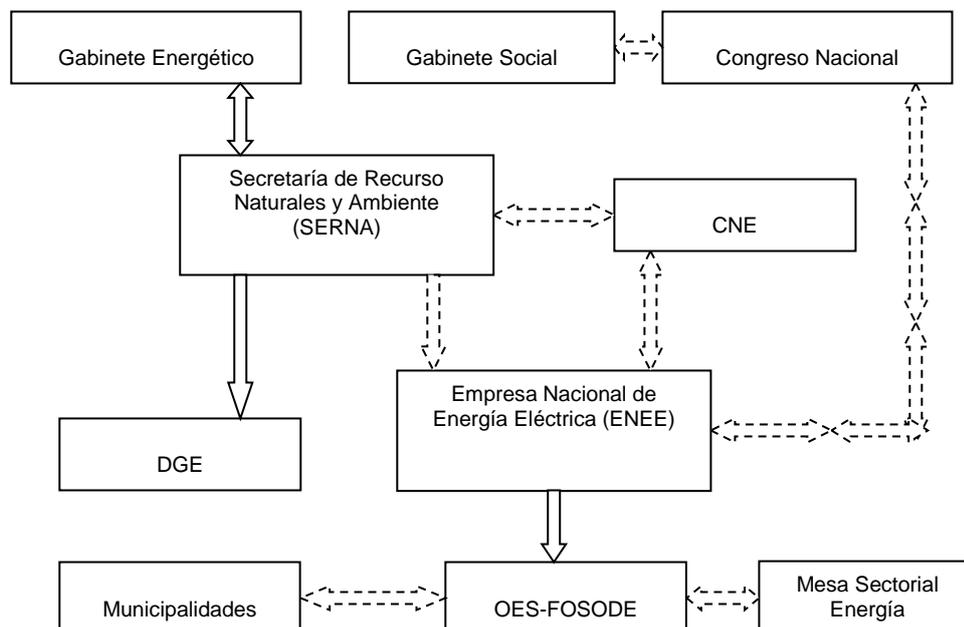
Even the Fondo Social de Desarrollo Eléctrico (FOSODE) which has been founded in 1994 with the aim to increase the electrification rate is managed by the Oficina de Electrificación Social (OES) as a subsection of the ENEE. Consequently all grid connected activities are implemented by the ENEE while SERNA in cooperation with some international donors (e.g. the EU in the GAUREE project) implements off grid projects based on solar and hydroenergy. At the same time even the ministries of health and education and the Consejo Hondureño de Ciencia y Tecnología – COHCIT (even with the rank of a ministry) have implemented some off grid renewable energy projects in Honduras parallelly and without coordination.

Also, during the restructuring in 1994 on base of the Ley Marco del Sub Sector Eléctrico, Decreto Legislativo No. 158-94) the Commission Nacional de Energía has been founded, which should regulate the Energy market but currently this institution seems to have no power and importance at all.

Honduras has participated in the HIPC initiative and developed a Poverty Reduction Strategy During this process, sector tables for the coordination of national policy with international donors and the participation of the civil society have been set up. Even if the former subsector table for energy has been validated by the new government as an own sector table, it is currently not working at all.

³ Source: INE 2001, Censo de Población y Vivienda

Public institutions working in the sector of rural energy supply:



Source: SERNA/DGE, OES-FOSODE

2.2.2 Electricity generation, transmission and distribution

Power Generation: ENEE owns 4 thermal power plants with a total capacity of 124 MW. Additionally, 7 hydropower plants with a total capacity of 464 MW are owned and operated by ENEE. The private power producers operate a total capacity of 957 MW (10 thermal power plants with 860 MW, 8 private hydropower plants with 37,5 MW and 8 biomass cogeneration plants with 59,8 MW). The Hydropower and biomass operators are organized in the Asociación Hondureña por pequeños proyectos de energía renovable – AHPPER.

Transmission: ENEE is operating the national grid (SIN).

Distribution: Monopoly by ENEE with the exception of some isolated grids on the bay islands (Roatán Electric Company” RECO, “Utila Power Company” UPCO, “Bonaca Electric Company” BELCO) and in Puerto Lempira, department Gracias a Díos (INELEM and ELESA).

2.2.3 Non governmental service providers for rural areas in the field of energy

Projects implementing NGOs:

The two Honduran NGOs AHDESA and PROLEÑA have experiences in the field of the introduction of improved stoves. They are both partners of the EnDev-HO Project and therefore later described (see chapter 3.1).

In the field of rural electrification there almost do not exist any information about Honduran NGOs that implement own projects. This reflects the strong monopoly of ENEE which still is regarded by the majority of the Hondurans as responsible for rural electrification.

However, some very small scale activities have been carried out by the Fundación Hondureña de Investigación Agrícola (FHIA) in the field of micro hydropower. As FHIA is also a partner of EnDev Ho it will be described in chapter 3.2.

The NGOs working in the field of development have founded the Federación de Organizaciones Privadas de Desarrollo – FOPRIDE, to better lobby their concerns to the national government.

Commercial service provider:

In the field of photovoltaic systems about 8 providers work in Honduras of which Solaris, Soluz, CADELGA and Soluciones Energeticas are the most important.

Especially Soluz accumulates interesting activities in the field of cash and credit sale as well as in offering fee for service options. About 6000 SHS have been sold to rural customers. The credit offer requires a 50% down payment and 3 to 6 monthly rates with an interest rate of 3 % per month.

The fee for service approach with 1500 SHS had to be terminated after the end of worldbank support, as the service fees have not been sufficient to cover the primary investments costs of the systems. SOLUZ has calculated that a monthly fee of 18 \$ would be required while the customer has to pay the battery by itself.

There exist very few producers of agriculture machines that produce hydropower turbines as well on very low technical level. Customers are mostly owners of coffee fincas.

2.3 Policy framework

2.3.1 Poverty reduction strategy

Honduras is one of five lowest income countries in Latin America. Its per capita income in 2004 was estimated at \$1,030, slightly above that of Guyana, Bolivia and Nicaragua, though more than twice that of Haiti. The population of about seven million grows at 2.5 percent per year. Poverty is widespread, particularly in rural areas where four out of ten people live in extreme poverty. Neither set of estimates shows any significant improvement over the past several years. In 2001 Honduras worked out a poverty reduction strategy which has become the guideline for the national development strategy. Although Honduras made some progress in reducing poverty regarding four of the Millennium Development Goals (MDGs) targets are not currently on track to be met by 2015 according to an evaluation of the World Bank.

The Honduran government considers the improvement of the infrastructure especially of energy service a key factor for economic growth and for the alleviation of poverty in rural areas.

2.3.2 Energy policy

As described above and based on the Ley Marco del Sub Sector Eléctrico of 1994, the policy regarding rural electrification is mainly developed and executed by ENEE via the OES-FOSODE. Even if FOSODE receives little more than a million \$ per year from the national government it was able to raise significant funds of international donors in the last decade, resulting in an annual budget of around \$10 million per year.

Programa Nacional de Electrificación Social Período 1995 – 2003

Origen de los Fondos	No. Proyectos	Financiamiento (M US\$)	Período
ENEE (ENEE)	123	2.93	1995 – 2001
FOSODE (GoH)	103	3.63	1995 – 2003
Asignaciones (GoH)	88	1.56	2001 – 2003
ER-580/91(BCIE)	182	18.88	1995 – 2003
Decreto 88 (GoH)	22	0.76	2001 – 2003
ES-N97 (Noruega)	89	2.71	1997 – 1998
ES-N98 (Noruega-BCIE)	185	7.82	1998 – 2003
Japón 1+2 (Japón)	371	4.00	1999 – 2003
ENEE-FCN (FCN – GoH)	76	2.70	2000 - 2003
Corea (Corea)	177	9.50	2004 – 2005
ES-N98-Amp 2 (BCIE)	105	10.11	2004 – 2005
Japón 3 (Japón)	101	5.88	2004 – 2005
NDF (Finlandia)	200	10.10	2004 – 2006
Total Ejecutado	1822	80.58	

Fuente: OES/FOSODE

Proyectos en Ejecución y por Ejecutar

Origen de los Fondos	No. Proyectos	Financiamiento (M US\$)	Período
ES-RP-2002 (BCIE)	413	12.72	2005 – 2007
PIR/BM	N/D	N/D	2005 – 2008
Electrificación Social (BID)	75	2.0	2005 – 2008
Total Ejecutado	488	14,72	

Fuente: OES/FOSODE

In this way ENEE could increase the electrification rate from 43% in 1994 to 69% in 2006. In 2002 ENEE with support of CIDA has developed a 'Plan Nacional de Electrificación Social' (PLANES) which aims to increase the coverage of the national grid to rural areas and peri-urban marginalised settlements. The scope of PLANES which covered initially only the timeframe up to 2012 has been increased by the government to an electrification rate of 80% in 2015.

Currently the activities are mainly concentrated on grid extension, as in the PLANES only the option of about 25 diesel powered minigrids has been included. The Worldbank is currently pushing to make FOSODE an independent institution promoting rural electrification and to focus more on off grid options using renewable energy.

In the field of off grid hydropower some experiences have been gained during the EU financed GAUREE project but though the project is conducted by ENEE the developed

capacities have not been incorporated into FOSODE and are under risk of dispersion when GAUREE II is finished.

Currently the OES-FOSODE prepares a Worldbank/GEF funded solar programme to disseminate Solar Home Systems in 2 pilot areas. The project which has been planned to start in January 2007 is now expected to run from 2008 to 2012. The SHS of 30/50/75 and 100 Wp are planned to be subsidised at a fixed rate of 270\$ per system, thus increasing the subsidies for the small systems compared to the larger ones. For the remaining payment credits with a payback time of 2-3 years shall be offered via microcredit institutions.

No national policy on the fuel wood consumption in rural areas exists. Activities in this sector focusing on the dissemination of improved stoves are spearheaded by the two NGOs PROLEÑA y AHDESA.

2.4 Key problems hampering access to modern energy services in rural areas

2.4.1 Obstacles for grid based rural electrification

Several factors handicap rural electrification in Honduras:

- a) Insufficient financial resources for investments in grid extension and installation of minigrids: ENEE as host of the OES-FOSODE takes the responsibility for rural electrification mainly by grid extension but the considerable funds made available by international donors are still not sufficient to reach the targeted increase from 69% in 2006 to 80% by 2015.
- b) Weak tariff structure and financial problems of ENEE: (a) cross subsidies to help the poorest customers proved to be badly targeted and unsustainable causing a constant loss of income for ENEE. (b) particularly commercial, industrial and public customers often don't pay their bills due to fraud or billing problems (60% of the non technical losses). (c) As 63% of the electricity generation is based on petrol, costs increase with the international petrol price. At the same time ENEE has to comply expensive power purchase agreements concluded during the energy crisis of the nineties. ENEE is not able to compensate this increased generation costs with the current tariff structure. As a consequence, important investments in the generation, transmission and distribution of infrastructure could not be made.
- c) Beside the still existing distribution monopoly of ENEE, private companies invest only in exceptional cases in minigrids as in the case of the bay islands where considerable resources and economic interest exist due to the strong tourism infrastructure. Normally, costs of providing access are too high due to remoteness of the sites, dispersed populations and difficulty of the terrain. Local communities don't dispose of sufficient proper financial resources to make infrastructure investments in their community.

2.4.2 Obstacles for off grid energy technologies and services

- a) There is strong political motivation to improve access to electricity of rural populations, particularly those remote from the grid. However, the cost of doing so has become increasingly high and there has been little effort to adopt new technologies and approaches. Grid extension is virtually the only approach by ENEE / OES-FOSODE to rural electrification and little attention has been paid to decentralized options.
- b) Other actors like SERNA or NGOs act uncoordinated from OES-FOSODE and lack sufficient financial resources to carry out dissemination programs for off-grid technologies.

- c) Lack of skills in operating small power generating plants and mini grids. There are few examples where micro and mini hydropower plants are managed successfully in rural areas in Honduras and the number of sufficiently qualified persons is low. This refers to technical skills necessary to maintain and repair the system as well as to management skills regarding appropriate tariff-setting and operation of the plant.
- d) Insufficient availability of micro-finance schemes for energy technologies in rural areas. Large parts of the country have almost no access to institutional micro-finance services and must rely largely on moneylenders, suppliers, family and friends for short term seasonal loans. There are no secure liquid savings options available to these households, which would enable them to build assets over time. Existing micro-finance institutions often have a narrow credit product line (e.g. Soluz offers credit sales but only with a down payment of 50% and a payback time up to 6 months), limited experience in rural markets and a lack of access to best practice information and technical tools.
- e) Lack of a marketing and maintenance structure for energy technology devices in rural areas. Almost all retailers are established in cities with no outlets in rural communities. Thus, clients have to travel to cities to purchase energy devices and for repair orders, which is difficult for most rural families. Establishing rural outlets are considered not to be profitable due to the high costs for transportation and mobilization, the dispersed nature of the populations and the low income and low demand of the local population.

3. Analysis and Assessment of the EnDev activities

EnDev Honduras is improving the access of rural households to three types of modern energy services: a) improved stoves, b) micro and pico hydropower, c) photovoltaic electricity. As an additional focus, the productive use of modern energy is promoted beside the interventions above in two specific projects which could not be analysed during this mission.

3.1 Improved stoves

EnDev-Honduras is promoting the dissemination of improved stoves via the two primary partner organisations PROLEÑA and AHDESA who train local cooperatives in the departments Occidente (PROLEÑA) and Olancho (AHDESA) to assemble and retail subsidised Justa stoves (a locally adopted type of rocket stove).

3.1.1 Market situation

In Honduras, wood is up to date the most important cooking fuel with a share of 84 % of the households using it exclusively for cooking. Another 13 % of the households use both, fuelwood and gas or electricity for cooking and only 3 % of the households cook exclusively with LPG or electricity. In majority the traditional not efficient stoves are in use and only in few departments as e.g. Lempira have improved stoves been disseminated on a significant scale (15-30 % of the households).

In the commercial sector a huge potential for the application of improved stoves exists (e.g. bakeries, brickworks, potteries, cacao dryers etc.) which has not been valued in the past activities.

Almost all disseminated improved stoves in Honduras have been subsidised in the course of social projects, only ADHESA tried to partially use a more commercial approach to cater the (peri-) urban middleclass, with moderate success (see below).

3.1.2 Activities of other stakeholders

Activities to introduce improved stoves in Honduras have been spearheaded by the NGOs PROLEÑA and AHDESA which have been also the partners of the EnDev Honduras project. There does not exist any significant sector policy in this regard.

The Asociación para el Fomento Dendroenergetico, PROLEÑA has been founded in 1993 and works mainly in the sector of forestry and reforestation with the aim to improve the sustainable use of fuelwood resources in Honduras. PROLEÑA has participated in the development of the Justa stove, a rocket type improved stove adopted to the local needs and cooking habits in Honduras. Furthermore mobile version, the 'Eco-Fogón' has been developed.

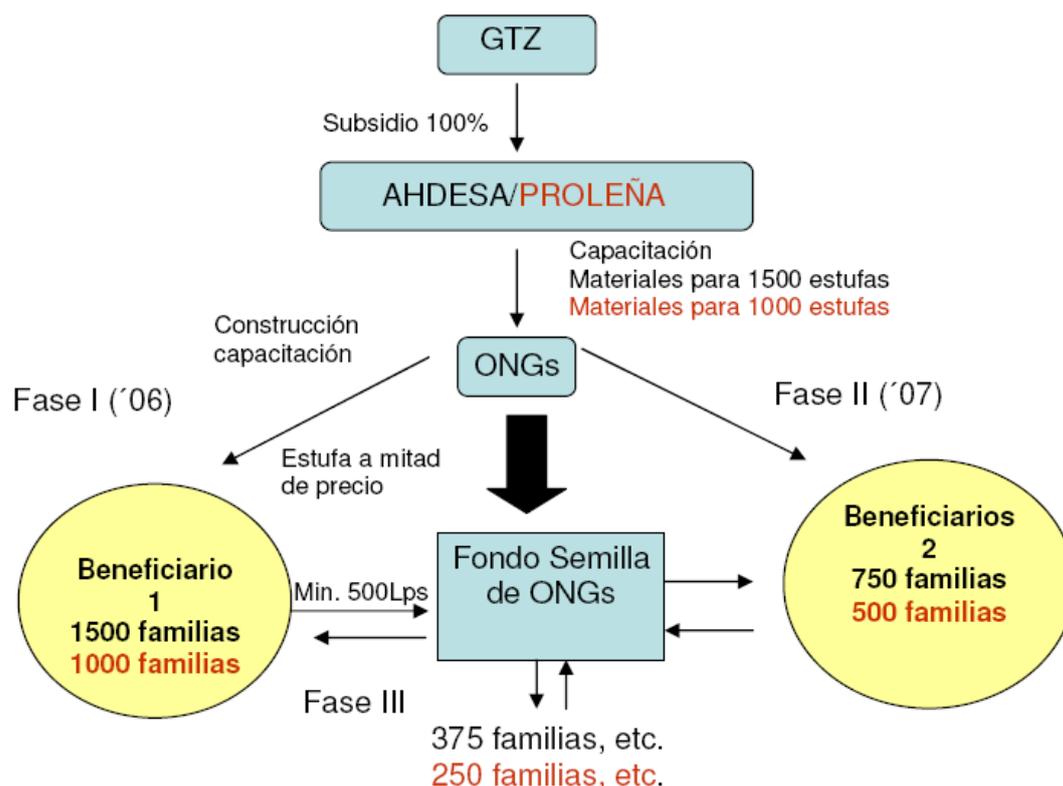
The Asociación Hondureña para el Desarrollo (AHDESA) has been founded in 1992 with the aim to promote rural socio-economical development by capacity building in the field of environment and sustainable agriculture. AHDESA started the dissemination of improved stoves in 1999 with the support of Aprovecho and Trees Water people (US). AHDESA has disseminated about 8500 subsidised stoves in rural areas. Additionally AHDESA sold 1000 improved stoves in (peri-) urban areas at a almost commercial level.

3.1.3 EnDev activities

The partnership with AHDESA and PROLEÑA has the objective of transferring the technology of Justa stoves to a local level in the region of Occidente and Moskitia (AHDESA) and Olancho (PROLEÑA). It is AHDESA's and PROLEÑA's responsibility to train local NGOs on how to construct Justa stoves and to deliver material for the construction of a total of 1,500 respective 1000 stoves to benefit the communities of intervention of these NGOs. In Occidente and Olancho the beneficiaries had to pay 500 Lps of the costs (1200 Lps) of the

stove. In Moskitia 72 stoves were disseminated which were all donated, due to the poverty level at hand. The money paid for the stoves stays in each local organisation as a seed fund to continue constructing Justa stoves. The structure of the financing agreement is explained in the figure below:

Set up of the intervention line for improved stoves:



Source: EnDev-Ho

EnDev Honduras has now stopped financing its partners AHDESA and PROLEÑA but in the department Occidente a last stove project with the target of 300 stoves will be financed with the local partner ODECO as the contract has been already signed in 2006. Afterwards, EnDev-Honduras will only continue to observe and monitor the impacts and number of accountable people reached until the project end.

The reasons for the withdrawal of EnDev-Honduras financing for improved stoves are several. On a global EnDev level it was decided to focus more on rural electrifications since targets for stove dissemination have already been reached. Furthermore the the target group of low income HH without access to modern cooking energy wasn't reached sufficiently and the 3 regions where PRORENA works there is no scarcity of firewood.

Nevertheless, as the Justa stove has been a success among other target groups and its quality is proven, PRORENA will continue supporting the initiatives by channelling other funds to organisations and individuals interested in promoting the technology in their regions. In the south of the country there is a firewood scarcity and EnDev Honduras will explore the option of cooperating with a regional GTZ project on desertification that is active in this region.

3.1.4 Technical aspects of the promoted energy services

Two aspects are important in the design of an improved stove:

- the heat transfer efficiency, as in an open fire only 10-40% of the released energy makes it into the pot
- the combustion efficiency (which is even in an open wood fire already around 90%) mostly to reduce smoke and harmful emissions that damage health

The Justa stove, based on the approved rocket stove design takes these aspects into account by maintaining the traditional practical design. It is a massive construction (see for pictures in the annex) which can be build mostly by local materials as only the metal plate and chimney and the clay combustion chamber need to be bought regionally. If used properly up to 70 % of the former fuelwood consumption with a traditional stove can be saved.

3.1.5 Financial and socio-economic aspects of the promoted energy service

The Justa stoves are produced and sold by local NGOs and cooperatives on a not for profit base. Cost price of the stove is \$60-70 which was completely subsidized in the first turn by EnDev-Ho while the buyers had to pay around \$25 for the stoves. The relatively high price is due to the metal plate, but this part can't be left out because of cooking habits in Honduras. Some financial arrangements are in place that allow people to pay back in 1 year. Usually paying isn't a big problem and happens in Dec or Jan when coffee has been harvested. When used properly the stove has a pay-back time of 5-8 months if people pay for fuel wood. Cost for wood are between 2.5 and 7.5 \$Cent per stick of which around 80 have been used per week in the traditional stoves. With the improved stoves the same amount is sufficient for up to a month resulting in a saving of \$6-\$18 per month. This makes the stoves attractive even to a commercial price in areas where fuelwood needs to be purchased.

(The original plans for a institutionalised revolving fund haven't worked out, mainly due to the general lack of microfinance institutions in the region and the too high management costs for a relatively small fund. Therefore a kind of informal revolving financing mechanism has been applied with the local partners, which receive 100% funding for the first phase to independently finance the subsequent phases. The recovery of the money from the users is generally not a problem, the payback culture is generally good in Honduras. However, the money recovered and managed by the local NGOs isn't always used to fund more stoves, so the term revolving fund is actually not right. In some communities there is no more demand for stoves, so other energy projects are considered while other NGOs are waiting for clearer instructions as to how to use the money.”

3.2 Mini grid electricity

Besides improved stoves EnDev-Honduras promotes household electrification through **micro hydro power** (MHP) plants. Partner institution is the NGO FHIA in the Atlántico region.

3.2.1 Market situation

There is a huge potential for hydro power generation in Honduras which is mostly used in medium to large grid connected hydropower plants. However, very little is known about the decentralised offgrid potential and the capacity to design and implement small-scale hydropower projects is still lacking.

USAID has commissioned a study on decentralised hydro potential carried out by the consulting ENKAR International. In this study 390 sites between 25 and 1000 kW have been identified of which 68 % are located in remote offgrid areas.

Some private coffee producers implement micro hydropower projects independently, but little is known about these experiences. Local construction capacity on turbines is very limited.

3.2.2 Activities of other stakeholders

Some experiences have been collected by the GAUREE (Generación Autónoma Renovable y Eficiencia Energética) project funded by the European Union and implemented by ENEE. Several sites with potential around 100 kW have been studied and two projects have been implemented. The Worldbank which also supported some micro hydropower projects through its 'Proyecto de Infraestructura Rural' (PIR) has shown interest to follow up on the soon completed GAUREE II project.

The Fundación Hondureña de Investigación Agrícola (FHIA) has implemented some micro hydro projects after the installation of a hydropower plant at a FHIA research site met the very interest of their surrounding target communities. FHIA is as well a partner of the EnDev-Ho project (see below).

3.2.3 EnDev activities

FHIA was founded in 1984 as a research institution for agriculture with a focus on Banana cultivation. It has been strongly supported until 1994 by USAID and the Honduran Government. Since 1994 the foundation is sustained by interests of its own fund and by national and international donors. FHIA has 318 employees in 5 research centres and works on Banana, Cacao and agro forestry as well as crop diversification and vegetable cultivation. The issues of natural resource management and reforestation are included in the work with small farmers.

A contract has been signed with FHIA to build three micro hydropower plants (each 12kW) and install 10 battery charging stations (including 7 communities which already have a micro hydropower plant) in 10 communities of the region of Atlántico. Electricity is used for lighting, social infrastructure (schools) and productive use in the 3 communities and for lighting only by the extended battery charging service in the other 7 communities. FHIA is responsible for the organisation of an administrative entity in each community which operates and maintains the systems and collects the fees. EnDev covered about 45% of the costs, the beneficiaries participated with labour force which is equivalent to 20% of the total costs. The remaining 35% are currently covered by FHIA. This percentage will probably decrease as EnDev-HO intends to pay back part of the technical advisory costs incurred by FHIA.

Pipeline:

A new partnership with the municipality of San Antonio de Oriente has the objective of providing the community of Los Lirios with nano hydropower turbines (200 W) for household lighting and a solar panel for the local school. GAUREE identified the project and supported the elaboration of the proposal for EnDev. The fees will be collected by a community organisation and transferred to the municipality which will be in charge of operating and maintaining the systems. EnDev will cover around 60% of the project costs, the other 40% will be provided by the municipality which will own the systems.

3.2.4 Technical aspects

In the three communities a locally produced micro turbine powers a 12 kW generator. 389 to 640 m tubes have been passed from the river intake to the machine house. A three phase low tension line of about 1 km connects the 30-40 households to the generator. The MHP are managed by the community and a technician checks the MHP twice a day. The households have now meters and fees are calculated as flat rates.

In the visited community the technical installations of the microhydro turbine and the minigrid showed some weaknesses, as the third low tension line was missing (because of budget constraints and a missing contact of the used generator) and the existing load controller has

not been connected yet which reduced the system capacity far below its theoretic size. These shortcomings are probably related to the budget constraints of FHIA (dispute between FHIA and EnDev-Ho about allowable project costs) and to the fact that FHIA as an organisation specialised in agricultural research misses some electrotechnical skills and focuses more on making the system run than to increase the system's stability and efficiency. There has been little awareness of a proper load management and a efficient use of the system beyond light bulbs in the evening hours (currently the system runs only from 4 pm to 6 am).

3.2.5 Economic aspects

EnDev Honduras contribution to FHIA is about \$50.000 and labour has been provided locally. The tariff approved in the communities is a flat rate of \$0.5 per lamp a month and families that haven't contributed labour pay an additional \$20 connection costs. The local operating association uses this money for maintenance and investments in the MHP. Through this project at least 1,300 people will be served with energy for lighting and small household applications. There is also potential for productive use in the communities targeted (e.g. sowing) which is expected to develop as soon as there is electricity. This will be closely monitored.

3.3 Photovoltaic electricity

As third intervention line EnDev-Honduras promotes the dissemination of Solar Home Systems. Partner institution is the NGO Hermandad de Honduras in the Ocotepeque region.

3.3.1 Market Situation

With an average solar radiation of 5.2 Kwh per square meter a day Honduras provides a favourable condition for the use of solar power. About 8 companies sell and install PV Systems in Honduras, the most important are Sistemas Solares de Honduras - SOLARIS, Soluz Honduras, Cadelga S.A., Soluciones Energéticas and Ecoaldeas. Solaris and Soluz alone have sold more than 11.000 SHS in rural areas (see chapter 2.2.3).

3.3.2 Activities of other stakeholders

Activities in the field of solar power can be divided in the areas of household use (SHS) social use (education, health and ICT) and productive use (irrigation). The social use had the most attention in Honduras starting during the eighties with activities of the US ENERSOL Associates Inc and funds from USAID. 1997 ENERSOL founded the Honduran branch ADESOL which is mainly active in water and education projects. Even the ministries of health and education carried out solar power projects but little is known about the current status of projects.

In 1999 the Consejo Hondureño de Ciencia y Tecnología - COHCIT implemented with support of UNESCO the Proyecto Aldea Solar in the community San Ramon, Choluteca. The project installed a complex and large PV mini grid which powered numerous applications as illumination, refrigeration, computers and telecommunication etc. COHCIT replicated this approach in several villages at smaller scale but little information exists on the long term viability of the systems. Critics of the project describe it as oversized, too expensive and too difficult to maintain for small remote communities.

Private customers are mainly targeted by the PV provider itself often in combination with some donor subsidy schemes. The risk of distortions caused by unspecific subsidies in this market segment is high.

The OES-FOSODE with funds from GEF/Worldbank is preparing a SHS programme which is planned to start by January 2008 with the aim to disseminate 5000 SHS in a period of 4

years (EUROSOLAR). The OES still elaborates its strategy evaluating the experiences collected in Bolivia and Nicaragua. Plans are to offer a fixed subsidy amount of \$270 per SHS, while the customer can choose between 30, 50, 75 and 100 Wp systems. Additionally a credit will be offered with a payback time of 2-3 years. For the project area 7 regions (mancomunidades) have been pre-selected by Government while the local authorities can specify the participating communities to concentrate the intervention and reduce the service costs for the system provider. Parallely a concession and open market approach shall be tested in different areas.

3.3.3 EnDev activities

The partnership with Hermandad de Honduras (HdH) has the objective of ensuring the sustainable community management of 87 Solar Home Systems for lighting and productive use (pulperías - small grocery stores) in 5 communities in the Ocotepeque region. The SHS are installed by Soluz Honduras which has provided also technical training. HdH has been responsible for identifying the demand (communities eligible) and supporting the creation of the community organisations through capacity building and awareness raising. The community association in the visited village seems to be properly set up, meets monthly and collects a fee of \$1.3 for spare parts and maintenance of the systems by a capacitated community member.

3.3.4 Technical aspects of the promoted energy services

The SHS consist of the following components (for photos see annex):

- 1x Kyocera KC50T panel with 54 Wp (25 years guarantee),
- 1x aluminium tube carry structure for the panel (10 years guarantee),
- 1x 12V, 105 Ah deep cycle solar battery (1.5 years guarantee) in a wooden protection box,
- 1x 6A, 12 VCC charge controller (1 year guarantee)
- 1x 400 W ACDC inverter with two sockets (1 year guarantee)
- 3x 7W CFL lamps
- Power cable, switches, tubes etc.

The system can power a radio and 4 lamps and a TV if used reasonably.

3.3.5 Financial and socio-economic aspects of the promoted energy service

The users have to pay \$241 and the municipal administration contributes \$59 per system, while EnDev subsidised \$370 for each System, the installation and the technical training and an additional \$115 per system for the institutional training by HdH. The local contribution has already been paid back to 71% the rest is planned to be paid by November 2007.

The mayor part of the target group cultivates coffee at small scale and can therefore afford a contribution of \$241 if they can pay the money after harvest. Still some families (12 of 30 in the visited community) could not participate, partly because they were sceptic about the project but partly because they could not afford their co-payment. The monthly collected fee of \$1.3 per family is not sufficient to replace the battery after 3 years, but people are aware of this fact. EnDev Honduras has contributed \$10,000 to Hermandad de Honduras for SHS, for capacity building. The SHS systems are bought through a tender made by GTZ and cost around \$60,000.

3.4 Energy for productive use

Two projects in the field of productive use are conducted by EnDev Ho; the introduction of three diesel engines for coffee producers with the partner COAFORPLA and the introduction

of improved drying ovens for cacao production with AHDESA. The projects could not be visited during the evaluation mission.

3.4.1 Market situation

Could not be assessed during the project visit.

3.4.2 Activities of other stakeholders

Could not be assessed during the project visit.

3.4.3 EnDev activities

The partnership with COAFORPLA has the objective of providing a diesel generator (by Comercial LAEISZ) for the operation of 3 diesel powered coffee processing machines (peeling, roasting and grinding) for the producers associated to this organisation and significantly improving their production, in quality and quantity. LAEISZ will be responsible for training the producers on the proper use and maintenance of the technology. EnDev will provide 73% of the financing (technology), the cooperative will cover 27% of the costs (installation costs, machine house, etc.)

The partnership with AHDESA has the objective of providing 3 Cacao producer associations with woodfuelled ovens for the drying of their product, significantly improving its quality and quantity. In the main association (KAWO BU KAYA), which also processes the cacao, 3 adapted Justa stoves will be installed for the roasting of cacao. AHDESA will be also responsible for training the producers on the proper use and maintenance of the technology. PRORENAs component Biósfera Río Plátano will ensure the organisation of the use of the technology and will constantly monitor the process, after the project end. EnDev will cover the costs of the technology and transportation (around 80% of the costs), the associations will pay the construction of the structure necessary to host the ovens (kiosk with roof) and working hours, which amounts to approximately 20% of the costs.

3.4.4 Technical aspects of the promoted energy services

Could not be assessed during the project visit.

3.4.5 Financial and socio-economic aspects of the promoted energy service

Could not be assessed during the project visit.

4 Outcomes, project impact and EnDev criteria

All analysis and calculations in the following chapter have been prepared based on the information available during the mission. Because some occurring problems in terms of additonality and free rider effects could not been quantified during the mission the task remains to the responsibility of the project monitoring. This might reduce the outcome numbers presented below and also change the calculations regarding the per capita efficiency.

The per capita cost are calculated based on the current share of indirect project costs of 55%. If the project can reduce the indirect cost significantly, this will direct lyinfluence the per capita costs.

4.1 Improved stoves

4.1.1 Outcome

Households:

2520 stoves have been disseminated in the regions of Olancho, Occidente, Atlántico and Biósfera Río Plátano. With an average household size of 5.1, 12,852 persons have been given access to improved cooking energy by May 2007. This is 31.5% of the planned 40,800 persons. The remaining stoves are to be financed from the funds of recuperated money controlled by the NGOs that have been trained. However there is no obligation for the NGOs to reinvest in stoves; they can also use the funds for other energy projects. And in some of the communities served the stoves demand has been satisfied already or they are not eligible for more stoves.

Of the former the targeted number of 8000 stoves it is assumed that approximately 3500 to 4000 can be reached before the end of the project period. However, it remains open how many of these stoves are accountable after the criteria of EnDev.

Social infrastructure:

In the Occidente region 4 schools have been supplied with improved stoves to provide meals for the children. In this way 1523 people are counted as provided with energy for social uses.

4.1.2 Project Impact as contribution to MDGs:

The stoves component has had an impact on the following MDGs:

1. MDG 1: eradicate extreme poverty and hunger
The Justa Stoves have achieved clear reductions of fuelwood use. Savings observed vary from 55%-75%. This comes down to a considerable saving of time abd reduction of workload in collecting fuelwood (none of the households visited bought their fuelwood).
2. MDG 4, 5 and 6: health related
The Justa Stoves have annihilated the smoke in the kitchen thus contributing considerably to the health of mainly women and children through the reduction of indoor air pollution. Also the Justa Stoves are spilling considerably less warmth than the semi-open stoves used before, which makes the temperature in the kitchen much more comfotable and healthy.
3. MDG 7: ensure environmental sustainability
The loss of environmental resources has been reverted by the Justa Stoves because of the significant reductions of fuelwood use.

4.1.3 Fulfilment of EnDev Criteria

Preliminary remark: our observations account for Occidente because we haven't been able to gather reliable data for Olancho. Because of the diversity of project implementation in

Occidente between the 11 participating NGOs, we can't even give a full picture for the whole of Occidente.

Chapter 5.3 contains additional observations and recommendations regarding the stoves component

a) Cost efficiency:

By May 2007 €95,300 had been spent on the stoves component. With 12,896 persons reached the cost-efficiency is €7.40 per person (project target has been €5.40 pp). But this number doesn't include the indirect costs of 55% in the case of Honduras. Cost-efficiency of the stoves component including indirect costs therefore comes to €16.40 pp.

Another observation to be made is that not all NGOs that disseminate stoves have offered a 50% subsidy to the users. Some are asking an (almost) full price which means that the subsidy for all stoves provided by EnDev is accumulating in the funds managed by the NGOs. Depending on what the NGOs do with the funds, the cost-efficiency might increase because of the lower rate of subsidies benefiting the users. This is very uncertain though.

b) Sustainability:

There is no guarantee for the stoves; users themselves are responsible for repairs. The Stove strategy in Honduras is quite sustainable because of the fact that local NGOs are trained to produce stoves and that they in their turn also train more producers from the communities served. Thus, people do not depend on far away companies for repairs. At the moment the delivery of materials (iron plate, chimney and rocket) by ADHESA from Tegucigalpa is a bottleneck, though some NGOs have established contacts with local suppliers.

Furthermore the first signs of a sustainable market have been observed; local producers are producing and selling stoves against commercial prices. NGOs are supposed to monitor these numbers but we don't have a total number available of these commercially produced stoves.

c) Scaling-up potential:

The scaling-up potential at least in Occidente is big; a considerable demand has been observed and also a paying capacity of unsubsidized stoves. The challenge is to scale-up to the poorer communities where subsidies are needed. For those NGOs depending on the delivery of materials by ADHESA there is a risk for scaling-up as ADHESA has difficulties to meet with the demand.

At the moment of the evaluation mission no exact numbers on scaling-up potential were available, also since it has been the policy not to extend this component within EnDev. In order to determine the exact potential the NGOs will have to identify eligible new communities in the intervention area.

d) Additionality and newly provided access:

There have been no other subsidies for the disseminated Justa Stoves nor any other stoves in the intervention area. The endogen dissemination of Justa Stoves in the area has been provoked by EnDev.

Households have been observed that already had access to modern cooking energy, through electric stoves (and one microwave). Despite the fact that this has already been observed in December⁴, no exact numbers on the level of no new access are known. EnDev

⁴ Observaciones y recomendaciones para la reformulación de la estrategia de manejo de los proyectos de energía para cocinar en las regiones de Occidente y Olancho, Ilka Buss, December 6, 2007. She also recommends to monitor the exact numbers of households that cannot be counted.

HO should investigate this. It must be mentioned that in Honduras electric stoves don't replace woodstoves; they are used for other types of meals. So the Justa stoves have replaced traditional inefficient woodstoves.

e) Accountability:

The stove component has been exclusively financed by EnDev, 100% of the intervention can be counted.

f) Intensity and complementarity of cooperation:

There is a complementary in the stove component in the sense that the disseminating NGOs are embedding the cooking energy activities in their already existing projects with environmental, social and/or economic perspectives. Also a combination has been made with the rural electrification component of EnDev-HO since rural electrification partners (such as FHIA and Hermandad de Honduras) are also disseminating stoves.

4.2 Micro hidropower plants

Chapter 5.3 contains additional observations and recommendations regarding the SHS intervention line.

4.2.1 Outcome

Households:

In the 3 villages El Recreo, Satalito and La Muralla micro hydropower plants have been installed with the contribution of the local community. 510 people are provided with electricity by the installed mini grids. Additionally about 640 persons will be served by the 10 battery charging stations that are still not installed completely. In total about 1150 persons will be served.

Social infrastructure:

3 schools and 1 community centre are connected to the 3 minigrids. As only 65% respectively 35% of the social infrastructure are covered, about 291 person can be counted as connected.

Productive use:

The 12.5 kW generators of the minigrids provide sufficient power for productive use, especially if operated during day time when private consume is low. In the visited community El Recreo the system worked only with two phase low tension line without electronic load controller at low system efficiency. Additionally the users have not been aware of productive potentials and load management of their mini grid. If a third phase and the (already existing) load controller are connected and users are capacitated for proper load management, the village could be counted also for productive use.

4.2.2 Project Impact as contribution to MDGs:

MDG 1: eradicate extreme poverty and hunger

The MHP minigrid enables users to make considerable savings on expenses on candles and kerosine/gasoline.

MDG 4, 5 and 6: health related

The MHP minigrid has annihilated indoor air pollution of kerosine/gasoline smoke and candles. It has also improved safety around the house.

MDG 7: ensure environmental sustainability

The MHP minigrid intervention line contributes to the environmental sustainability through reduced use of kerosene/gasoline and small batteries (for radios for instance). Additionally there is an increased awareness of the importance of a proper watershed management and reforestation to secure long term water resources.

Another impact of the MHP minigrid is the improved access to information and communication devices such as mobile phones, television and radio.

4.2.3 Fulfilment of EnDev Criteria

a) Cost efficiency:

The costs are at €60 pp including indirect costs only counting households and social infrastructure. If technical installation and load management are improved as described above, cost efficiency rises to €43 pp.

b) Sustainability:

In the community El Recreo the operation village association has been properly set up and has developed a tariff system which defines a fee of €0.5 per lamp and month. The association meets every two weeks and people pay their fee during the meetings. Until now 1-7 7W CLF lamps per household are the main use of the electricity, but already two families bought TVs and some a ventilator. Therefore some readjustments of the tariff system are necessary even to regulate possible productive applications.

There is a young technician qualified to run the turbine daily from 4 pm to 6 am and the whole weekend without interruption. The first technician qualified by FHIA has already left the village, so there is a certain risk that this could happen again.

c) Scaling-up potential:

FHIA has identified several more similar project sites and a replication of 2-3 projects seems possible until the end of the project period.

d) Additionality and newly provided access:

The community of El Recreo already tried to install the turbine on their own, but chose a wrong water intake with the consequence of a not sufficient decline. With the support of EnDev the turbine could be installed at a proper place and a mini grid could be installed.

It seems that no battery systems existed in El Recreo in significant numbers. For the whole intervention this question should be included in the monitoring.

e) Accountability:

The intervention has been financed by local and municipal contributions, by EnDev and FHIA. As FHIA expects to get their direct cost covered by EnDev-Ho the intervention can be 100% counted. If FHIA would contribute own funds to the direct project costs (which are not related to their own ongoing activities in the project area) their share of the output would not be accountable for EnDev.

f) Intensity and complementarity of cooperation:

The Atlantic region is no project area of the GTZ PRORENA programme, but EnDev-Ho selected with FHIA an experienced partner with ongoing activities in the target area. The introduction of hydropower plants is very complementary for the FHIA activity of resource and watershed management as the involved communities develop a own interest in the protection of water resources.

4.3 Photovoltaic systems

Chapter 5.3 contains additional observations and recommendations regarding the SHS intervention line.

4.3.1 Outcome

Households:

At the time of the evaluation mission 87 SHS had been installed by HdH/SOLUZ in 5 communities in the Ocotepeque department, serving 553 persons in total. All 87 systems are installed in private homes, no social institutions nor productive use. In reality a larger number of persons benefit since community members with no SHS have access to their neighbours system for charging the batteries of their mobile phones and watching TV.

Productive use:

In three communities are four grocery shops illuminated and counted as productive use for this families resulting in 29 person in the category of productive use.

Pipeline:

Till project end another 87 systems are planned to be installed for which there is no lack of demand. Three factors endanger the full achievement of the target by January 2008:

1. at the time of the evaluation only 71% of the users contribution was recovered and the deadline for the remaining 29% is end of November 2007. So its uncertain if HdH will have enough cash to pre-finance the 87 remaining systems.
2. HdH has been paid \$10.000 to promote the project and to accompany the local communities in the implementation, for instance by setting-up a community SHS committee. The contract ended in June 2007 and the majority of the \$10.000 has been spent so there is no 100% guarantee that HdH will invest the same effort to install the remaining 87 systems.
3. 87 households have been provided in the first turn and with the payment of the user completed by November 2007 other 87 SHS shall be disseminated. But in this way only \$52,200 (2 x 87 x \$300) will be raised while a system costs about \$670, which means only 78 SHS can be financed if HdH cannot mobilise additional funding or increase the local contribution.

Another challenge is to identify communities that are more eligible for EnDev, in order to avoid the free rider effect and no new access that has occurred sometimes in the first phase.

4.3.2 Project Impact as contribution to MDGs:

The SHS intervention line has had an impact on the following MDGs:

MDG 1: eradicate extreme poverty and hunger

The SHS enables users to make considerable savings on expenses on candles and kerosine/gasoline. Exact data on the savings are lacking but the previous monthly expenses on lighting add to about \$5 a month, while monthly costs (in Bañaderos) now are down to \$1.3, the contribution to the communal fund for repairs and replacements. This doesn't include savings on charging mobile phones (most households have at least one). The majority (71%) has already paid for the SHS after the coffee harvest so they don't count with monthly reimbursements.

Another effect reported is the extension of productive hours during the harvest season since the SHS enables women to prepare meals and do other household work after dusk.

MDG 4, 5 and 6: health related

The SHS has annihilated indoor air pollution of kerosine/gasoline smoke and candles. It has also improved safety around the house.

MDG 7: ensure environmental sustainability

The SHS intervention line contributes to the environmental sustainability through reduced use of kerosine/gasoline and small batteries (for radios for instance). Attention needs to be paid to proper dumping or recycling of the SHS batteries since at least in Bañaderos there was little awareness regarding this issue.

Another impact of the SHS is the improved access to information and communication devices such as mobile phones, television and radio.

4.3.3 Fulfilment of EnDev Criteria

a) Cost efficiency:

The SHS line is not cost-efficient; per capita costs add up to € 240 if only the first 87 systems are counted and indirect costs included. Costs can be broken down into € 56 for the system, € 18 for HdH and € 90 (55%) indirect costs. When the second phase of 87 systems is implemented (and HdH doesn't claim another \$10.000) costs decrease to € 128 (€ 60 for SHS and € 68 for indirect costs). This amount could even decrease if the contributions of the municipality are used to decrease the subsidy instead of the contribution of the users.

b) Sustainability

Several measures have been taken to ensure the sustainability of the PV intervention line:

- The SHS users have been successfully trained by SOLUZ in proper use and maintenance of the SHS. Apart from that in each community some members have been trained to assist in the installation of the panels and to do simple repairs.
- In each community a SHS committee is in place to discuss issues related to the SHS and to collect a small monthly contribution (\$1.3) for a fund for repairs and replacement of light bulbs. It can also contribute to the replacement of batteries.
- Especially HdH, but also SOLUZ, continue being present in the region even after EnDev-HO might come to an end.

The national PV market seems to be pretty sustainable, with 2 big players and several smaller players providing PV systems of different types. SOLARIS and SOLUZ have so far sold 11,000 systems to private persons in rural areas and also supplies for other international donors and the World Bank. Subsidized systems have to be disseminated with a lot of care to avoid disturbing the market by funding SHS for people that don't really need a subsidy.

c) Scaling-up potential:

There is a considerable scaling-up potential and several communities in the Ocotepeque region have shown an interest. Since within the present project period another 87 systems are due for which communities are starting to be identified now, one can doubt whether scaling-up before January 2008 is realistic. The demand is not an obstacle but the selection of eligible communities and the formation of a Solar Committee is, in terms of time.

There are also scaling-up possibilities with SOLUZ or other providers directly that would probably cost less time, but then it would be less community based, more individual. EnDev-HO would have to support the provider in their own or provide linkage to other microfinancing capacities.

Directions for scaling-up include battery charging systems and social institutions.

d) Additionality and newly provided access:

There have been no other subsidies for the disseminated SHS in the intervention area. Some families in the area already had a SHS or decided to buy one independently when the delivery of SHS through EnDev-HO was delayed. So a free rider effect has been observed and EnDev-HO should identify the exact number.

We have observed one case where there was no new access; the family already had a SHS (that they will sell now). In the case a family already had a (car) battery for lighting and TV it depends on how far the quality of the service has been increased by the intervention. E.g. the distance and costs for charging the battery are very high resulting in an occasional charging every few weeks, then the improvement by the SHS or local battery charging station is sufficiently significant to speak of a new access. If the family charges their battery regularly and is only saving some time and money this would not be sufficient to count as new access. In case of doubt a detailed baseline has to clarify and document the situation.

e) Accountability:

The SHS intervention line has only been co-financed by the users and the local municipality so 100% of the intervention can be counted.

f) Intensity and complementarity of cooperation:

The SHS component is well embedded in the socio-economic interventions of HdH in the area. Although HdH hadn't worked with PRORENA Occidente before, the present activities also mutually enhance the efforts of both organisations in the region. The SHS intervention is also in line with planned government activities to provide poor people with PV systems through EUROSOLAR.

5 Observations and Recommendations

5.1 General Observations

The overall perception of the EnDev Honduras programme with about 70% of the total budget booked (see table below).

Intervention line	Target numbers	Expected numbers	Stoves incl. pipeline	MHP	SHS	Others and pipeline
Energy for Households:	5.625	2.131	0	1.149	919	63
Energy for cooking:	40.800	20.000	20.000	0	0	0
Energy for social infrastructure:	2.750	2.058	1.523	291	0	244
Energy f. prod. use/income generation:	6.975	2.081	0	510	29	1542
Total:	56.150	26.270	21.523	1.950	948	1849

The difference between targeted and expected figures are mainly caused:

- 30% of the budget has not been spent yet, so more people can be expected due to electrification projects.
- The stove component has in some points the potential to reach more people if existing organisation and communication gaps are solved, but it is unclear how many will be reached until project end and how possible ongoing activities of local partners could be monitored. At the same time the number could decrease due to the mismatch of the EnDev criteria for the target group.

Below we made a SWOT analysis on the level of the programme in general:

Strengths:

- Successful implementation of activities on the ground through EnDev-HO partner organizations. The effects add to the achievement of the **MDGs**, specifically in saving money and time, reducing workload, extending productive hours (MDG 1), improving the health situation (MDGs 4-6) and environmental sustainability (MDG 8).
- **Demonstration effect** has stirred a demand especially for stoves and PV. This wouldn't have been achieved without the intervention of EnDev-HO. Sometimes promotion and awareness building seems more important than the subsidy to convince people.
- The **contribution of end users** is relatively high: 50% in the case of stoves and PV.
- Activities have been **embedded** in other areas such as environment (f.i. forest and watershed management) and social organization (saving/credit groups and energy committees)
- Using the existing contacts of **PRORENA** Occidente, Olancho y Biósfera Río Platano has had an added value especially because of their existing relationships with local NGOs.

Weaknesses:

- Weak strategic **programme planning**: several project phases are observed at one time, such as acquisition, contract negotiation, consolidation, scaling-up.
 - The **contracts** with FHIA, HdH and the NGOs participating in the stoves components lack clarity. Arrangements for output, selection criteria, timeframe, specified budget, use of recovered money in funds are either missing or not clear enough.
 - The perspective of building **strategic partnerships** with organizations that after a while could work with a certain independence towards EnDev goals hasn't been part of the planning nor of the implementation.
 - Planning with partners wasn't performance based towards increasing **targets** (number of people connected). Rather partners received global budgets to spend and missed any incentive to increase numbers of people connected.
 - **EnDev criteria** such as economic sustainability (income of producers, market development), exit strategy, additionality and scaling-up potential as well as the **indirect costs** haven't been taken into account properly at the time of project planning.
- **Indirect costs** are high: 55% of the EnDev HO budget. This has a negative effect on the cost-effectiveness of all intervention lines.
- **EnDev selection criteria** haven't been communicated and monitored well enough to avoid free rider effect observed especially in stoves and PV. Same goes for new access.
- **Relationship with partners** sometimes is not optimal because of unclearities (e.g. FHIA, PROLEÑA) and there is an incoherence in set-up with similar partners (FHIA and HdH).
- **Set-up of the EnDev team** isn't optimal: the practical task division is unclear, external communication lines aren't uniform, task division is not always logic e.g. people responsible for an intervention line are not the first contact person for the partners related to that line.
- A number of these weaknesses and problems caused by the way the programme is planned have already been observed, reported and discussed in December 2006, but **earlier recommendations** haven't been followed up.

Opportunities:

- So far many experiences with different partners and types of activities have been gained and these result in a good starting point for further profiling of the programme.

Threats:

- There is a risk that the targeted number of people won't be reached. Several reasons:
 1. EnDev rules are not always applied so some users are not eligible (no new access).
 2. There is a risk that the funds of the collected money won't lead to more people getting access to modern energy. Unclearity of the rules might lead to NGOs putting the funds to another use.
 3. Given the absence or late date of a deadline for money to be recovered there is a risk that by the time the money will be fully recovered, the EnDev-HO project has come to an end.

5.2 General recommendations:

To EnDev Ho:

- **Internally:** clarify task divisions and responsibilities within the team and unify external communication lines
- **Externally:** clarify and level contracts, criteria and agreements with existing partners for instance through an addendum to the existing contract or a new contract.
- Assess the estimated number of people that are not eligible according to EnDev criteria and estimate the realistic number of people to be reached before project end.
Recalculate the target numbers and per capita costs accordingly and if needed indicate also the numbers of people that are expected to be reached after project end.
- **Remaining budget:** focus on quickly upscaling existing activities with existing partners. Don't look for new types of activities and partners. Upscaling options that can be investigated:
 - FHIA (2-3 more microturbines)
 - HdH with PV providers e.g. SOLARIS, SOLUZ (no committee building, microcredits from other part of HdH? Analyse acceptance of smaller systems, include Social Institutions if sustainable operation can be guaranteed, No battery charging because of the more complicated and expensive institutional approach.)
 - Stoves: low-cost upscaling in Occidente because of the high potential under clear conditions

In case of a intended scaling-up (see below) present planning documents for the complete ongoing budget including direct and indirect costs, number of beneficiaries and per capita costs as soon as possible but at the latest for the 1st of September.
- In case promising scaling-up potential beyond the remaining budget capacities can be identified: clarify with the GTZ P&E if resources are still available for 2008 and prepare a proposal for **the period after Jan 2008** by 1st of September 2007 at the latest that includes:
 - a clear and credible strategy for PV and Microhydro. Might include grid extension if cost-effective (goal 20 euro per person including all costs)
 - a strategy to reach poorer communities and to avoid freerider effect
 - a lower percentage of indirect costs
 - a clear and logic set-up and task-division of the team

5.3 Specific observations and recommendations

5.3.1 Improved stoves

Strengths:

- **Multiplier effect achieved** (in Occidente) because the NGOs trained by ADHESA in stove production have trained local producers and both are now producing for an autonomous demand and a more less commercial price. The demonstration and promotion by the NGOs in the communities seems to have caused this effect as much as the subsidies. The reason improved stoves were absent before the intervention is probably the unawareness and lack of offer in combination with the lack of money. The balance between these two elements depends on the poverty of the specific community

and the time of the year. People tend to have more to spend after the harvest (Jan-March).

- Justa stove technology matches the local demand; **users are satisfied**. If compared to the LORENA that was disseminated earlier, the appropriation of the Justa has been smooth, cultural problems have been overcome quickly. It seems that it has been hard to identify volunteers for the first stoves and after that other community members have followed the example quickly, even without subsidy.
- A certain level of **collaboration between the participating NGOs** has been reached though this hasn't been institutionalised. NGOs have made agreements on stove prices and made arrangements for local supply of materials.

Weaknesses:

- **Instructions for participating NGOs are unclear**. Especially regarding the eligibility of beneficiaries, pricing of the stoves and use of the funds of recuperated money there are many differences and deviations from the intended set-up of the component. This results in the fact that some beneficiaries can't be counted (freerider and no new access) and confusion as to the use of the recuperated money. Some NGOs take up their own strategy in (re)directing the funds while others are awaiting while their fund is growing and project end is coming up. This observation was already made and communicated in the evaluation report of December 2006, but it doesn't seem to have been taken up in the meantime.
- There is a **planning problem** in the sense that during the highly subsidized first phase there was a considerable freerider effect, while there is a risk that the poorer communities won't be able to participate in the second unsubsidised phase.
- There is a **contradiction in the strategy of the component**: many people were trained to produce stoves, but there is no long term plan for the commercialization of the stoves through these producers.

Recommendations:

- For the second phase **communicate the instructions clearly and formally to the NGOs** and monitor (for instance through PRORENA Occidente) the follow-up of these instructions.
- Develop a clear **exit strategy** aiming at a sustainable and independent dissemination of stoves by the local NGOs and producers.
- **Scale-up** within the current period with a clear aim to avoid the freerider effect. For instance by assisting the NGOs to select eligible communities and consciously directing subsidies to poor people or developing a favourable subsidy scheme.

5.3.2 Micro hidropower plants

Strengths:

- With FHIA a **strong local partner** has been identified who has already worked with the communities and has implemented some pilot projects before.
- The **strong involvement of the communities** in the construction of the MHP created a clear ownership.
- **Clear rules, responsibilities and tariffs** managed by local association with regular meetings.

- Per capita costs more in the target range as the PV project (43 Euro including productive use)

Weaknesses:

- **Unsolved problems** between Endev and FHIA regarding financial aspects of the contract (unspecific budget and activities, unclear rights and duties)
- FHIA seems to need some **technical support** itself, but is not openly recognising it. The visited installation seemed not to work properly, as only two of three lines have been installed due two budget constraints. Without the third line the village cannot be counted for productive use due to the **instability of the system**.
- **Tariff system** only reflects light bulbs, extra regulation for ventilators, TVs etc. are needed. Awareness and capacity for proper load management and productive use of the electricity are not sufficient.

Recommendations:

- **Solve conflicts** on rights and duties in the contract with FHIA to establish a stable partnership
- To **follow up on technical installation** (third power line), institution building (tariff system) and load management. Provide necessary technical support to FHIA.
- **Continue cooperation** in building 2-3 more plants as far as it is possible to implement until the end of the year (FHIA has confirmed it would be) keeping the limits of 30 Euro (\$20 direct costs) per Person reached, but counting as well social infrastructure (as fare as existent) and productive uses (as fare as the installation provides sufficient stable capacity).
- **Exchange experiences** with Nicaragua, especially for the construction of turbines as a local Nicaraguan producer near Matagalpa works already on a more advanced level constructing the same type of turbines used by FHIA.

5.3.3 Solar Home Systems

Strengths:

- **Solid intervention** because of strong counterparts: HdH with high credibility in the communities and a lot of experience in setting-up local organizational structures. SOLUZ with a good product, intensive capacity building and a balance between a commercial and a social perspective.
- Willingness to **co-finance by the municipalities**

Weaknesses:

- So far the intervention is quite **expensive**: € 128 pp (€ 60 systems, € 68 indirect costs) even if the second 87 systems are counted. It is doubtful whether cost-efficiency calculations have been made beforehand. Costs for HdH are high, they add €8.40 to the price pp.
- In the Bañaderos (one of the richer communities served) a **free rider effect** has been observed; some community members didn't need the subsidy since they bought a system independently when EnDev-HO took too long. Also a case of no new access has been observed.
HdH states that to avoid these effects was not part of their selection criteria; only willingness to participate in the installation work, presence at committee meetings and paying capacity.

- A **planning problem** regarding the remaining 87 systems is foreseen since 29% of the funds is due to be recovered only by the end of Nov 2007 while the project period ends in January 2008.

Recommendations

- Make sure that HdH installs the remaining 87 systems before project end in communities that meet with the EnDev criteria and without an additional contribution from EnDev for HdH.
- Investigate the feasibility of **scaling-up** up within the current project period. Options to bring down costs and serve the poorest communities include: including municipality contributions in the subsidy half, disseminate cheaper systems of 35W (\$400), serve social institutions and no new expensive institution building. Ideal cost pp is €30 (\$20 direct costs).
- Extension period: identify other options like battery charging and direct promotion through SOLUZ with some credit contribution.

Annex

A.1 Terms of Reference for the PPR appraiser

PROPUESTA DE TÉRMINOS DE REFERENCIA PARA MISIÓN DE EVALUACIÓN DE ENDEV-HO

I. Objetivo General de la Misión

Evaluar y conocer por parte de la Central de GTZ y Senternovem los proyectos desarrollados por EnDev Honduras con sus socios estratégicos. Así mismo, recomendar las líneas para la factibilidad de un segundo financiamiento del Gobierno Holandés para el 2008. Criterios básicos de la evaluación son la replicabilidad de los proyectos y su eficiencia económica en términos de costos por beneficiario.

II. ALCANCES PROPUESTOS

A. De la Evaluación. Conocer y evaluar el proyecto EnDev-HO en base a la información del proyecto, entrevistas con socios estratégicos, beneficiarios(as) y personal técnico de PRORENA y EnDev-HO, así como visitas de campo, con la finalidad de establecer las directrices de orientación para las acciones futuras del proyecto.

B. Ampliación del financiamiento. Considerar las expectativas y la demanda para ampliar los montos para financiamiento de subsidios para proyectos energéticos y establecer las recomendaciones y estrategia para lograr este propósito.

C. Lineamientos Generales

- Conocer y evaluar in situ de los alcances de las iniciativas financiadas y en ejecución de distintos proyectos subsidiados por EnDev-HO.
- Orientar a EnDev-HO sobre las actividades a realizar en base a las líneas de acción aprobadas: Energía para iluminación, infraestructura social y usos productivos.
- Orientar sobre los mecanismos y líneas para extensión de fondos adicionales para Honduras.
- Interactuar con socios estratégicos de iniciativas de proyecto con subsidios de EnDev y actores clave de PRORENA a fin de conocer de lecciones aprendidas y planes relacionados con la sostenibilidad de procesos.
- Conocer la vinculación de las iniciativas de EnDev-HO desarrolladas por socios estratégicos en relación a temas ambientales, de salud, conservación, manejo sostenible de los recursos naturales y procesos vinculados al desarrollo humano sostenible.
- Conocer y recomendar sobre la propuesta de estrategia de EnDev-HO que será presentada en el marco de la visita de la Misión de Evaluación.
- Conocer y recomendar sobre la estrategia de rotación de los fondos asignados a las ONGs y Organizaciones de base a fin de multiplicar la experiencia sobre el tema de fogones mejorados y sistemas energéticos.
- Conocer la vinculación de EnDev-HO a los propósitos y acciones de PRORENA.

- Conocer sobre las potencialidades del aporte de EnDev-HO al desarrollo humano sostenible de comunidades pobres de Honduras.
- Considerar las recomendaciones de EnDev-Ho basadas en lecciones aprendidas a fin de establecer posibles ajustes a la estrategia de ejecución.
- Informarse del aporte de EnDev-HO al fortalecimiento y generación de capacidades locales a través de socios estratégicos y actores clave de las ONGs y Organizaciones de base al nivel comunitario.
- Recibir los informes pertinentes a los avances y planes de EnDev-HO.
- Redactar un documento de recomendaciones para el cumplimiento de las metas y propósitos de EnDev-HO en su fase final de ejecución.

III. PRODUCTOS SEGÚN LA AGENDA PROPUESTA

A. Entrevistas

- Conocer de los propósitos generales de PRORENA GTZ y la contribución de EnDev-HO como producto de la articulación con los Componentes regionales de PRORENA.
- Conocer del informe de avances de EnDev-HO y del reporte de monitoreo.
- Entrevistar y conocer las experiencias, expectativas y percepciones de socios estratégicos nacionales, personal técnico y directivo regional de PRORENA y beneficiarios(as) comunitarios de EnDev-HO.

B. Visitas de campo.

- Visita de campo y verificar in situ de los alcances y resultados de proyectos subsidiados con recursos del proyecto.
- Entrevistar a beneficiarias(os) directos e indirectos del proyecto.
- Entrevistar a socios estratégicos que facilitan y acompañan el proceso de asistencia y capacitación a los(as) beneficiarios(as) de los proyectos energéticos.
- Percibir y visualizar impactos conexos producto de la articulación de EnDev-HO y los socios estratégicos en el área ambiental, de salud, fortalecimiento organizacional, generación de capacidades locales y manejo sostenible de los recursos naturales, entre otros temas.
- Considerar las recomendaciones pertinentes para mejorar las estrategias de EnDev-HO en su etapa futura.
- Percibir y escuchar sobre lecciones, estrategias de sostenibilidad y expectativas de beneficiarias(os), socios estratégicos, técnicos enlace y facilitadores de campo de PRORENA en lo relativo a proyectos energéticos vinculados al desarrollo sostenible de comunidades pobres.

C. De las conclusiones y recomendaciones de la Misión de Evaluación.

- Reporte de evaluación y recomendaciones para el seguimiento y culminación de las acciones de EnDev-HO.
- Recomendaciones pertinentes a la gestión de recursos adicionales para EnDev-HO.

IV. POTENCIALES ENTREVISTAS

A. Socios estratégicos.

- **AHDESA.** ONG con experiencia en la promoción, capacitación de tecnologías de fogones mejorados y hornos secadores para cacao, hornos de pan, entre otros.
- **PROLEÑA.** ONG con experiencia en la promoción, capacitación de tecnologías de fogones mejorados fogones mejorados.
- **Hermandad de Honduras.** ONG con experiencia en sistemas financieros, capacitación organizacional y acompañamiento de procesos.
- **FHIA.** Fundación con experiencia en investigación agrícola, manejo de micro cuencas, acompañamiento de procesos comunitarios y sistemas pico hidro energéticos.
- **ORDIH.** ONG beneficiaria en materia de fogones mejorados.

B. Aliados

- Oficina de Electrificación Social, coordinadora del fondo social de electrificación de la Empresa de Energía Eléctrica (ENEE).

C. Beneficiarios(as). Considerar al azar en las áreas comunitarias a visitar. Considerar a las organizaciones comunitarias organizadas como Entes Administradores de los Sistemas Energéticos ó patronatos de luz.

D. Personal técnico enlace y directivo de PRORENA. Considerar entre otras, las siguientes personas:

- Ing. Zoila Patricia Cruz.
- Ing. David Ordóñez.
- Ing. Winfried Brakhan (ATP Occidente).
- Christine Woda (Biosfera del Río Plátano)
- Helmunt Dotzauer (ATP Biosfera del Rio Plátano)

E. Autoridades Municipales. Los Alcaldes han comprometido apoyo y en algunos casos recursos destinados a las comunidades en su gestión y desarrollo de proyectos energéticos. Se pueden **opcionalmente** considerar entrevistas con los siguientes Alcaldes:

- Sr. Alcalde de Concepción, Ocotepeque.
- Sr. Alcalde de Santa Fé, Ocotepeque.
- Sr. Alcalde de Dolores, Ocotepeque.
- Sr. Alcalde de la Masica, Atlántida.

F. Empresas Privadas. El proyecto ha contratado para compra de sistemas fotovoltaicos, mediante proceso de concurso público, a la **Empresa SOLUZ**, la cual potencialmente podría ser entrevistada por la Misión de Evaluación.

A.2 PPR procedure / time schedule

Fecha	Actividad	Actores(as)
Domingo 03 de Junio	Llegada del equipo evaluador	Organizar llegada de visitantes casa Ilka Buss.
Lunes 04 de Junio	<p><u>Mañana:</u></p> <p>08:00 -09:45 Reunión con equipo Técnico EnDev-HO.</p> <p>09:45 – 10:00 Receso</p> <p>10:00 – 11:00 Reunión personal Biosfera del río Plátano</p> <p>11:00 – 12:30 Entrevistas a PROLEÑA, AHDESA.</p> <p>12:30 – 0200 p. m. Entrevista con Sra. Christel Weller Molongua y Almuerzo</p> <p>02:00 – 03:00 Reunión PRORENA Olancho</p> <p>03:00 – 03:30 Receso</p> <p>03:30 – 04.00 Entrevista Ing. Miguel Rodezno, Oficina de Electrificación Social (OES), de la Empresa Nacional de Energía Eléctrica (ENEE).</p> <p>04.00 – 05:00 Trabajo libre para la Misión de Evaluación.</p> <p>07:00 – 10: 00 Carne asada de bienvenida en la casa de Ilka Buss.</p>	<p>Maartje op de Coul, Mirco Gaul, Ilka Buss, Oscar Aguilar, Glenda Mejia, Andreas Gettkant, René Benítez R.</p> <p>Christine Woda / Helmut Dotzauer</p> <p>Maartje op de Coul, Mirco Gaul, Luis Valle, Carlos Sandoval, Ignacio Osorto, Anibal Osorto.</p> <p>Maartje op de Coul, Mirco Gaul, Andreas Gettkant, Christel Weller Molongua, Ilka Buss.</p> <p>Ing. Zoila P. Cruz, Leonardo Espinoza, Maartje op de Coul, Mirco Gaul.</p> <p>Maartje op de Coul, Mirco Gaul, Ing. Miguel Rodezno.</p> <p>Maartje op de Coul, Mirco Gaul,</p> <p>TODAS (OS).</p>
Martes 05 de Junio	<p>Mañana: Viaje a la Ceiba en avión y a "El Recreo", La Masica, en vehículo.</p> <p>Almuerzo con representantes de la comunidad, FHIA y Alcaldía Municipal</p> <p>Tarde: Visita de la represa, turbina hidroeléctrica.</p> <p>Salida a San Pedro Sula: Hotel Sula</p>	<p>Representantes de la comunidad.</p> <p>Dr. Adolfo Martínez, Ing. Jesús Sanchez</p> <p>Misión y Equipo Técnico EnDev-HO.</p>

<p>Miércoles 06 de Junio</p>	<p>Mañana: Viaje a Ocotepeque a la comunidad "El Olvidito" Almuerzo: Restaurante Titos, Santa Fe, Ocotepeque.</p> <p>Tarde: Visita de la comunidad "El Olvidito" e inspección de los sistemas fotovoltaicos. Luego entrevista con Hermandad de Honduras.</p> <p>Pernoctar: Hotel Sandoval de Ocotepeque.</p>	<p>Maartje op de Coul, Mirco Gaul, Equipo Técnico EnDev-HO.</p> <p>Representantes Comunitarios, beneficiarios (as); Sr. Jesús Alonso Pineda, Manuel A. Mejía de Hermandad de Honduras.</p> <p>Misión y Equipo Técnico EnDev-HO.</p>
<p>Jueves 07 de Junio</p>	<p>07:30 – 08:30 a. m. Viaje a San Marcos de Ocotepeque, Oficinas de Hermandad de H.</p> <p>08:30-09:00 Entrevista con Sr. Alcalde de Dolores, Merendón.</p> <p>09:00 – 12:00 Visitas de campo para inspeccionar ecofogones construidos en las comunidades de El Tablón y Sinacar del municipio de San Francisco del Valle Ocotepeque.</p> <p>ALMUERZO</p> <p>Tarde: Visita Grupos Meta de ONGs: ODECO, Corquín, Copán, Sr. Edilberto Estebes.</p> <p>En función del tiempo, se podrá visitar Talgua, ORDIH, Sr. Claro Lara</p>	<p>Sr. Alcalde Francisco Portillo, Maartje op de Coul, Mirco Gaul.</p> <p>Misión de Evaluación, Equipo Técnico EnDev-HO y personal de Hermandad de Honduras.</p> <p>Hotel Colonial, La Labor</p> <p>Misión de Evaluación, Equipo Técnico EnDev-HO y personal de ODECO.</p> <p>Misión de Evaluación, Equipo Técnico EnDev-HO y personal de ONG: ORDIH.</p>
<p>Viernes 08 de Junio</p>	<p>Mañana: Viaje de retorno a Tegucigalpa (7 horas aproximadamente).</p>	
<p>Sábado 09 de Junio</p>	<p>12:00 – 16:00 Reunión Equipo Técnico de Endev-HO.</p>	<p>Maartje op de Coul, Mirco Gaul, Ilka Buss, Oscar Aguilar, Glenda Mejía, René Benítez R.</p>

A.3 List of sources

1. HONDURAS - Temas y Opciones del Sector Energía, Informe Final, 27 de abril de 2007, Asociación de Desarrollo Internacional (ADI) en cooperación con la Secretaría de Recursos Naturales y Ambiente (SERNA), la Comisión Presidencial de Modernización del Estado (CPME), y la Empresa Nacional de Energía Eléctrica (ENEE).
2.

A.4 Photo documentation