

MERCY CORPS, CLIMATE CHANGE UNIT
ADDRESSING ENERGY POVERTY IN TIMOR LESTE

INDONESIA, FULL REPORT

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SUMMARY

Since independence the need for energy for communities who are off-grid has been recognized by many develop actors. There is a clear need for better cooking technology; small capacity of solar home lighting systems; solar cookers. Deforestation for cooking fuel has focused attention on the need for sustainable resource management practices in mangrove and terrestrial forest through a combination of replanting and development of income streams from planting, harvesting and sale of fuel wood. Currently > 95% of the population depends of fuel wood collection for cooking; this is unsustainable as increased deforestation, forest fires and landslides attest to.

Mercy Corps conducted a study with two foci; a field assessment of energy poverty and a review of the experiences of previous community energy projects and related government energy policy. The study looked for commonality and differences in approach and how these led to success or failure.

The findings were initially intended to help guide development of appropriate strategies for Mercy Corps to play a role in addressing energy poverty on the long-term, particularly for communities off grid, particularly given its strengths in microfinance and community mobilization, linked to alternative energy. They resulted, however, in recognition of an urgent need to convene government, private sector and the NGO-Donor community to take a united and systematic approach to the problem of energy poverty and the dramatic social and environmental costs that undermine self-sufficiency across the country.

Energy and communities

The two greatest energy needs are for lighting and cooking. Kerosene and candles are the principal sources of lighting, but these are not enough. Kerosene supplies are often limited and prices are both volatile and high. A lack of light is widely perceived as a handicap. Communities identified a series of income generating activities, requiring light, that are restricted because of a lack of power. These include income generating activities including sewing and repair of fishing nets; handicraft production; cooking snacks for sale. But equally as important are activities including school study, community meetings and general household lighting. There is a gender aspect here too: as one informant stated, *most household activities are done by women and children* – a lack of lighting impacts them the most.

Cooking depends almost entirely on fuel wood collection, which has dramatic costs in terms of cash and time. The average consumption of fuel wood for one household is roughly 60 kg. If purchased, this has a cost of roughly US\$ 3, an option used by only 10% of urban village. Others have to forage. Yet foraging for wood is time consuming, with significant impacts for families. Households have to collect 3 - 4 times weekly and over distances of 2 - 3 km. Time spent varies from 8 - 15 hours per week. The burden for fuel collection falls upon the whole family, diverting time from income generation and education. For example, children collect on weekends, in the afternoon after return from school and as well as on holidays, diverting time from study. This adds to the impact of not being able to study at night when light is not available.

Energy projects

A wide range of actors from different sectors have been involved in energy project or business development in Timor Leste. The diversity of actors is complemented by a diversity of energy sources that have been piloted including agro-energy, biogas, hydro, fuel efficient stoves, solar and an emerging interest in wind. A variety of management models have complemented these, and only community-based models have shown potential for success.

No project has shown capacity to succeed on a self-sustain economic scale. Major obstacles are:

- Energy installations in public buildings are not maintained.
- Lack of understanding about energy installations leads to misuse of facilities.
- Volunteerism to support energy project does not work.
- A lack of standards and guidelines results implementing poor quality systems with communities.
- Communities in rural areas do not have access to service providers and suppliers of spare parts.
- Complicated technology is difficult for communities to maintain.
- Social aspects and a sense of ownership are ignored in projects.
- Lack of data and information.
- No proper coordination channel for locals when they face problems.
- Complete absence of any access to finance for enterprise development in the energy sector.

Steps forward

Two issues are clear. Energy poverty is a fundamental and long term need for communities across Timor Leste; not addressing it will accrue ever more social and environmental costs. And whereas this has been recognized, response has been limited to small pilot projects that fail because a variety of limiting factors.

Mercy Corps recommends a convening of donors and international NGOs, government, community leaders and the private sector to set a direction for addressing energy poverty for communities likely to be left of the grid. Three themes will be addressed:

1. Business models for financing and sustaining energy poverty solutions.
2. Standards for equipment and community mobilization.
3. Job creation in alternative energy solutions and fuel wood planting.

At this convention these themes should be developed into action points that different parties, in concert can develop into a business plan that holistically address the energy poverty problem sustainably and effectively at scale.

INTRODUCTION

This report documents energy poverty and its implications through study with two foci. The first was a field assessment of energy poverty, including its primary and secondary impacts, in three districts of Timor Leste. The second was reviewed the experiences of previous community energy projects and related government energy policy, seeking commonality and differences in approach and how these led to success or failure. The assessment looks into environmental implications of energy poverty, in particular deforestation of mangrove and terrestrial forest as a cheap, if diminishing, source of fuel.

The findings are intended to help guide development of appropriate strategies that address energy poverty on the long-term, particularly for communities off grid. Mercy Corps' has strong interests in sustainable economic development built on collaboration between civil society, the private sector and government.

Mercy Corps recognizes a clear need for energy provision in Timor Leste for those who are, and likely will remain off the grid for many years; better cooking technology; small capacity of solar home lighting systems; solar cookers; adoption of sustainable resource management practices of mangrove and terrestrial forest through a combination of replanting and development of income streams from planting, harvesting and sale of fuel wood. Activities will need to be supported by parallel development of capacity among communities, local businesses and NGOs for resource management planning, business development and financial models.

Mercy Corps believes that such a program needs to be based on a clear understanding of community needs and context. As a first step toward development of a country wide program aimed at addressing energy poverty, with supporting outcomes in better natural resource management for freeing time and income for families who have no likelihood of receiving public electric utilities even in the distant future.

Timor Leste – development challenges

Timor Leste became a sovereign democracy in 1999. It is among the world's poorest countries and faces high youth unemployment together with the highest fertility rate in the world. Coupled with a legacy of violent conflict, poor economic performance and weak democratic institutions the country is at risk of becoming a chronic fragile state.

Nationally, a lack of infrastructure and skilled labor are major obstacles to national development. When separated from Indonesia in 1999, the outgoing security forces seriously damaged or destroyed approximately 85% of infrastructure and other assets. These included hospitals, power stations, schools, offices, houses, market places, water systems, the port and property such as cars. A critical shortage of skilled labor despite chronic unemployment, particularly among youth, hinders progress further. It remains a consistent problem in sectors including education, the police service, medical professionals and management. It includes a lack of qualified personnel able to effectively run key facilities such as power stations.

Energy and environment

For communities, the lack of infrastructure keeps energy poverty high on the development agenda. Only 20% households in Timor Leste have access to electricity, with most limited to urban areas (World Bank/NORPLAN 2005). Access to electricity in rural areas is limited to 6 -10% of households in rural areas have access to electricity. In turn, the lack of skills has hindered development of sustainable, alternative energy solutions.

Efforts to address energy poverty have been made by government, international organizations including World Bank, UN Agencies and NGOs through studies and piloting technology models. Yet none has brought about a self-sustaining economic model that survives after project cycles ended; none has therefore been sustainable.

The combination of energy poverty and high unemployment increases deforestation. With many unskilled people, particularly in rural areas, trying to find a way to generate income, cutting trees and selling timber is common practice. A recent World Bank study reports 98.6 % of both rural and urban communities in Timor Leste relying on fuel wood as their main source for cooking. A lack of land tenure opens forests to a "tragedy of the commons"; without recognized ownership many forest areas are open to uncontrolled use. As Timor Leste's

mountainous terrain is degraded, particularly around urban and peri-urban areas, erosion, landslides and large scale fires are increasing in number and scale.

As the report discusses, the renewable energy industry in Timor-Leste is in its infancy. There continue to be pilot project are undertaken by NGOs and international agencies. They have generally introduced diverse types of renewable energy technologies in rural areas and have not been designed to achieve necessary economic scale to carry forward sustainably. Examples of these technologies include solar lanterns, community facility solar systems to run TV and DVD devices, solar water pumps to provide clean water, fuel efficient stoves, biogas plants and solar home lighting systems. The government has also installed some large solar modules on village office roofs to run TV, DVD and satellite receiver dish antennas. The intention has been to provide power and opportunity to rural communities to access to information, entertainment, strengthening their social capital through social activities and also to provide light for alphabetical program.

Throughout the assessment there have been two consistent themes that have led to project failure. The first, as alluded to before, is the lack of focus on developing economic scale that would let an intervention take off as a self-sustaining business enterprise. Yet more disturbingly, the study identifies that community involvement and participation in energy projects in generally minimal at best. There has been insufficient mobilization of grass roots support to engender strong ownership within communities. As one informant reported on his community following installation of a solar power system on a village office roof installed in early 2008:

"...they do not know how to fix system when it breaks, they also do not know who will supply and provide spare parts in future. There are no technical manuals for operation and maintenance".





THE ASSESSMENT

Objective

The objectives of the assessment were review of:

1. Experience from past and present projects trying to address energy poverty, and supporting government policy, through stakeholder interviews in Dili.
2. Energy needs, opportunities, and challenges to meeting in meeting them through surveys of representative communities in three districts.

Six activities guided the review process:

- Identification of past and existing renewable energy projects and survey of failure and success characteristics.
- Preparation of a community energy assessment tool and conduct surveys in nine energy-deprived communities in three different and geographically distinct districts.
- Identification of local NGOs who successfully completed or collaborated in relevant projects along with their interest in involvement in further activities, willingness to partner with other agencies and internal capacity.
- Identification of private sector companies working in alternative energy technologies with particular focus on their community reach and supply chains.
- Identification of market demand for fuel wood and other timber resources, and likelihood for community tree out grower schemes to address it.
- Identification of likely regulatory supportive institutions and regulations, and potential obstacles to developing an energy poverty reduction program.

Assessment team & schedule

The assessment activity was conducted by Mercy Corps Timor Leste and lead by its Program Coordinator Paulo da Silva. Four community surveyors were recruited for 10 day community energy assessments. The assessment was conducted in the period September - November 2008. The first month in Dili identified renewable energy projects as well as related institutions. The second phase of the assessment focused on field assessments.

Dili consultative meetings

Interviews were held with representatives from the private sector, NGOs and relevant government ministries (table 1):

Table 1: Consultative meeting stakeholders

Sector	Institution	Representative
Gov	Secretary State for Energy Policy	Lino Correia, Research Officer
Gov	Secretary State for Energy Policy	Marcos do Santos, General Director
UN	UNDP - PRDEP	Pedro Sarmento, Program assistant
NGO	Rural Development	Josefina Olderico
NGO	BELUN	Luis, Program Coordinator
NGO	Roman Luan	Guido Araujo, Director
NGO	Naroman Timor Foundation	Marchal Hornai, Director
Private	Startec Enterprise	Kim Tchia, Director
Private	Kyocera - Singapore	Shaun Lim, Assistant Sales Manager
Private	Hydro Timor	Kassius Klei Ximenes, Project Manager
Donor	Norplan	Bento Xavier, Research Officer
Gov	Forestry Department	Mario Nunes, National Director
NGO	Community Edmund Rise	Br. Bill, Resident Coordinator
Gov	Business Registration Department	Domingos Gutteres
Gov	National Procurement	Evangelina A Gutteres, Procurement Officer
Gov	CV Penuh Jaya	Tadius Utomo, Representative
Private	Eron Power, Lda.	Nazario A. Gutteres
Gov	Ministry of State Administration	Aderito Alves, Procurement Officer
NGO	Cooperative Coffee Timor	Shane Mackay, Advisor
NGO	Haburas Foundation	Nick, Researcher

Field assessments

Sites

Three districts were selected to conduct community energy assessments; Manatuto, Dili and Ainaro. These represented a mixture of peri-urban, rural and remote rural areas. Within each, three communities (table 1) were chosen to conduct the survey, two rural and one urban¹. 140 households were surveyed in total.

Table 2: Communities surveyed

Dili	Manatuto	Ainaro
Hera	Kairui	Maubise*
Camea*	Aillili* and Sau	Edi
Sabuli	Manuleu	Hohorai kiik

*Urban Villages

Methodology

A questionnaire (Annex A) was developed. Households were interviewed on energy activities including energy sources used, household energy expenditure and demand.

Information was supplemented by informal interviews with *suco* chiefs and other community leaders including school heads and religion leaders.

Field teams also noted existing renewable energy facilities if present including solar lighting systems on community buildings, solar water pumps, solar home lighting systems, biogas plants and fuel wood efficient stoves. Teams also observed traditional cooking styles such as three-stone fires and food preparation techniques, as well as types and quantity of fuel woods.

Limitations were encountered during surveys. Some community members were uncomfortable giving complete answers. Likewise in Dili, some institutions were reticent in providing information. Finally, government institutions sometimes had difficulty in accessing required data.

¹ The definition of an "urban" community is taken from the 2004 Timor Leste census; there are 38 identified in the country



COMMUNITY ENERGY USE AND DEMAND

Survey results indicate the greatest energy needs identified by communities are for light and cooking fuel.

Lighting – fuel use and demand

Use

Kerosene, candle, electricity, solar power and wood were the main source of energy among communities visited. Most use wood for cooking, candle or kerosene for light at night. For some, kerosene is prohibitively expensive, for others periodically available. For the poorest, including widows and other vulnerable people, wood is used for lighting and some even burn old rubber sandals.

Households often use more than one energy source for lighting (table 3) at night. A switch from kerosene to candle can follow a shortage of the fuel from outlets, or a shortfall in household income. A lack of light is seen as a handicap. As reported by one impoverished mother, candle light is only used for dinners and never more than for two to three hours in one night. Her children can only study for one hour after sunset.

Table 3: Community light sources

Energy source	% households
Kerosene	67
Candle	77
Electricity	59*
Solar	11
Biogas	<1
Wood	6

**6 hrs a night at most*

Some communities surveyed are classified as urban and have access to electricity at night. Yet electricity runs for only five to six hours at best; communities are forced to resort to candle or kerosene if they still want to be active after sunset.

Demand & Expenditure

Light is necessary for nighttime activities. Energy poverty affecting access to suitable lighting has drastic impacts on all aspects of household wellbeing. Consistent among interviewees was the demand for electric light, their ultimate preference for grid power (128 out of 140 households). Second came solar power (54 households) if grid access was not available. The reasons why they prefer grid and solar power options are:

- Less work on maintenance.
- Electricity can be also be used for other electrical appliances
- No health risk compared to kerosene and fuel wood.
- Solar power is a free power source.

Balancing these views, some community said kerosene and candle are acceptable providing they are available and cheap.

Communities identified a series of income generating activities, requiring light, that are restricted because of a lack of power. These include:

- Sewing and repair of fishing nets.
- Handicrafts production; baskets, hats, and wood statues.
- Keeping kiosks open.
- Cooking snacks for sale.
- Vegetable processing.

Equally as important are non-economic activities including school study, community meetings and general household lighting. There is a gender aspect here too: as one informant stated, *most household activities are done by women and children* – a lack of lighting impacts them the most.

Developing a clear picture of overall *market demand* for energy is outside the boundary of this assessment. It is clear from interviews that communities feel the impact of not having adequate energy sources; demand for the activities that adequate lighting would facilitate is clear. An understanding of the energy products and willingness or ability to afford them is not.

Patterns of current expenditure that could be reallocated to improved technology are a little clearer. Most community members appear to burn 1.5 – 2 l of kerosene a week with the cost of kerosene at \$1.5 to \$2/l. Costs vary among villages. In general, rural communities pay the most; one liter of kerosene costs about \$1.25 in urban settings but in remote areas doubles to \$2 - \$2.5.

Besides burning kerosene, some community also are using candle for lights at night.

There are two different sizes of candles, a large size candle costs \$0.75 and small and short one costs \$0.30. They used three packs per night, so about 21 packs are burnt every week.

Cooking – fuel use and demand

Use

Out of the 140 households surveyed, 139 use wood as their main fuel. The majority of households collect resources in forest, mountainside and river banks.

Demand

The average consumption of fuel wood for one household is roughly 60 kg. If purchased, this has a cost of roughly US\$ 3, an option used by only 10% of urban village. Others have to forage.

Forage for wood is time consuming, with significant impacts for families. Households have to collect 3 - 4 times weekly and over distances of 2 – 3 km. Time spent varies from 8 – 15 hours per week.

Table 4: Fuel wood collection participants in households

Member of family	% of households
Wife	72.85
Husband	77.85
Children (boy >10)	21.43
Children (girl >10)	12.85

The burden for fuel collection falls upon the whole family, diverting time from income generation and education. For example, children collect on weekends, in the afternoon after return from school and as well as on holidays, diverting time from study. This compounds the impact of not being able to study at night when light is not available.

Environmental impact of fuel wood collection

It is alarming that 98% of the surveyed population uses fuel wood as the primary fuel for cooking. Despite of some degree of awareness of the impact of cutting forests and not replanting trees, there is little interest in reforestation as no direct economic benefits are perceived.

This is compounded by a lack of sense of ownership over the forest resource. Forest is considered Government property that is not managed or otherwise controlled. Agro-forestry, which surveys showed to be more attractive than safeguarding natural forest given the opportunity to plant high value trees such as teak, is not considered viable because of a lack of land tenure. People are reluctant to grow trees on land they do not own for fear of losing the products of their labor to government or someone else.

The Government is, however, prioritizing reforestation in areas of Dili, Liquica and Manatutu Districts. These are categorized as the worst affected by deforestation and there are fears they will cause natural disasters because of fire. Part of this effort will be a civic education program on forestry issues.



ENERGY PROJECTS

Actors

A wide range of actors from different sectors have been involved in energy project or business development in Timor Leste.

Government

There is policy in place supporting village energy self-sufficiency. The Secretary State for Energy Policy undertakes some related projects to provide lights and power to rural peoples. Ongoing government studies are identifying villages for alternative energy activities. These will also recommend what areas that will depend on alternative solutions to grid coverage over the coming five to ten years.

Currently the Secretary of State for Energy Policy is preparing national decree law for renewable energy. The content of this law will relate to national energy policies and give general guidelines for energy project implementations. It is expected to be finalized in 2009.

Donors

There have been various types and scales of energy projects funded by different donors. Table 5 illustrates the types and scale of projects implemented:

Table 5: Donors and types of energy projects implemented

No	Institution	Types of Projects and System Capacities	Remark
1	Government of RDTL	<p>Solar Projects</p> <ul style="list-style-type: none"> Solar home lighting system for households (61.4KWp) Solar water pump (12.88 KWp) Solar power system (144.92KW) <p><i>Total Solar Power from the Government of RDTL is 219.2KWp</i></p> <p>Biogas</p> <ul style="list-style-type: none"> 9 biogas plants for households (Suai, Viqueque and Lospalos, Manatuto, Liquica and Ermera) 	For households, clinics, suco offices and public street
2	UNDP	<p>Solar Projects:</p> <ul style="list-style-type: none"> Solar home lighting system (5.05KWp) <p>Biogas</p> <ul style="list-style-type: none"> 24 biogas plants for cooking and lighting <p>Fuel wood efficient stoves</p> <ul style="list-style-type: none"> 120 stoves in Kamea (Dili) 80 stoves in Metiaut (Dili) 	For households

No	Institution	Types of Projects and System Capacities	Remark
3	UNDESA	Solar Projects <ul style="list-style-type: none"> 14 community solar systems with capacity of 5.2KWp 470 portable solar lanterns with total capacity of 4.7KWp One 3.15KWp Solar Water Pump Total Solar Power Capacities from UNDESA is <i>13.05KWp</i>	For schools, community halls, households and sub district administration office
4	EU - Triangle	Solar Projects <ul style="list-style-type: none"> 2 systems of solar water pump with capacity of 5.28KWp 	
5	UK – Belun and Raimar	1.12KWp	For Community
6	Alternative Technology Association (ATA)	Solar Projects <ul style="list-style-type: none"> Total capacity of 5.322KWp installed 2.11KWp to be completed at the end of 2008. Total Solar Power Capacities from ATA is <i>7.432KWp</i> Wind Projects <ul style="list-style-type: none"> 3 sites of wind project survey (Lequidoe, Atauro and Oecusse) 	For schools, orphanage, clinics, community halls, local government and police stations.
7	Australia Rotary Club -Community Edmund Rise	Solar Projects <ul style="list-style-type: none"> In total of 2.51KWp Portable solar lanterns In total of 44.85KWp Solar home lighting system installed About 2.4KWp solar panels for others Total Solar Power Capacities from CER is <i>49.76KWp</i>	For households
8	UK Gov. through Haburas	108Wp Solar lighting system	For Eco tourisms
9	Private	800Wp Solar home system	Community bought
10	Norplan (Norway Gov.)	Solar Projects <ul style="list-style-type: none"> One 170Wp solar power system Hydro Projects <ul style="list-style-type: none"> 326KW Mini Hydro Power (completed) Iralalaro and other hydro power sites studies 	Solar power was installed on a school roof

Private Sector

Various companies are involved in sale and installation of alternative energy products (table 6) that are affordable to at least some communities. Three of the most notable are Eron Power, Startec Enterprises and CV Penuh Jaya. Each has strong links with manufactures in other countries. None have business representative in any district. They do, however, have staff skilled in solar home lighting systems.

Table 6: Private sector energy actors

Company	Programs	Based	Remarks
Eron Power, Lda	Supply, Install and train solar home lighting systems, supply electrical and electronic equipments	Bairo dos Coceiros, Dili – Timor Leste	Timorese owned, with 5 electrical and electronic and solar home lighting systems experienced staff. Have installed more than 100 solar home lighting systems. Train locals on basic operation and maintenance.

Company	Programs	Based	Remarks
Startec Enterprises	Supply solar components, electrical and electronic components. Supply and install also Air Conditioning	Audian – Dili – Timor Leste	Timorese (Chinese descendent) owned, with 15 years of experiences in electrical and electronic director; has installed 450 solar power systems
CV Penuh Jaya	Supply and install solar home lighting system, solar street light, solar power plant etc.	Colmera – Dili – Timor Leste	Indonesian owned and has installed more than 400 solar power and home lighting systems
Bravo International	Supply electrical and electronics equipments	Lecidere – Dili – Timor Leste	Can supply also solar components
Roise2 NA Unipessoal, Lda	Supply Solar home lighting system components	Dili – Timor Leste	Supply solar components for Health Ministry
Ted Lay Company	Supply solar components	Dili – Timor Leste	The company only supply solar components

NGOs

There are local NGOs interested in alternative energy project (table 7) in areas including solar lanterns, water pumps home lighting system, and also fuel efficient stoves.

Table 7: NGOs involved in alternative energy

Organization	Experience in			Base
	Solar projects	Forest and Environment	Fuel Efficient Stove	
CPT	✓	-	-	Dili
Haburas Foundation	✓	✓	✓	Dili
NTF	✓	-	-	Dili
Rolu	✓	-	-	Atauro
Raimar	✓	-	-	Atauro
Permatil	-	-	✓	Dili

All have strong community mobilization skills and some basic solar technical skills, with experience in facilitating program beneficiaries to discuss and establish management committees and producing internal energy regulation as day to day facility management guidelines.

Haburas has a strong commitment on environmental issues. It is researching development of new technology for improved cooking stoves by using local raw materials with a focus on creating job opportunities for youth.

Types of energy

The diversity of actors is complemented by a diversity of energy sources that have been piloted.

Agro-energy

An agro-energy program is underway, initiated by the State Secretary state Energy Policy. The main focus of this program is planting jatropha as an energy crop. The program will be implemented through community groups, cooperatives and community based organizations based on their request. There have been 43 requests from various communities throughout the country; half have been funded and others are in planning. For the 2008 financial fiscal, the project was US\$ 382, 500. Implementation is intended for areas categorized as having non productive soil.

Biogas

Biogas projects in Timor Leste are supported by both government and non-government agencies including UNDP and Caritas.

The Government of Timor Leste, via the State Secretary for Energy Policy has constructed nine biogas plants in five districts; Suai, Lospalos, Ermera, Liquica, Manatuto and Viqueque, based on communities requests.

UNDP has been involved in 24 biogas plants across 7 communities. Of the 24, 21 systems are complete and the rest are in progress. These rely on animal waste that needs to be collected twice a week. The gas is used for cooking and power for light bulbs.

Caritas built a concentrated biogas plant in Guico – Loes in 2005, fueled by animal waste from tethered livestock. The project was implemented by community members under the supervision of a biogas expert from Philippine. The system was built to provide power for cooking and lights. It involved 30 to 40 households at the beginning reduced to 3 households as most community members withdrew support. The effort needed to collect grass and clean the facility was too much. Also, efforts feel disproportionately on a few community members.

Hydro

In Timor Leste, there are two mini hydro plant projects. Norway Aid build a facility in Garuai, Baucau Sub District at a cost of US\$2 million. Water is collected from two springs and piped 1.7 km to a turbine. This powers a 326 KW generator. The project took four years and employed 1500 local people before handover to the Government Electricity Department (EDTL). The system feeds into the Baucau grid system and supplies power to the nearest sub districts. The second, in progress, is being developed by the government for Loihunu. Details are scarce and this is reported to have a completion date in 2009.

Other projects are under study. A proposal for Iralalaru, Lospalos, is near completion. The system will produce about 189 GWhr every year with a turbine capacity of about 14 MW derived from a flow rate of 10000 liters/second. The estimated cost is about US\$ 90 million plus another US\$ 34 million for transmission lines to Dili. An estimated 5,000 – 10,000 jobs will be created during construction.

Another for Atsabe is almost finalized, now focusing on an environment impact study that will be completed in early 2009. This will produce about 11 MW and cost about US\$15 million to complete. There are concerns that during dry seasons output will be reduced to 200 KW.

A plan to install a 740 KW plant in Bulobo, Maliana, is under discussion, with Lacro and Irabere also included. Norplan is contemplating involvement with these depending on opinion from the government.

Fuel wood efficient wood stoves

The survey identified more > 360 (rough estimation) fuel wood stoves installed in Timor Leste. The largest was a UNDP program that installed 200 units in 2007. Most beneficiaries are satisfied because of benefits including:

- Keeping kitchen clear of smoke
- Less wood used
- Time saved
- More comfort, compared to sitting on the floor tending a fire
- Ability to cook in more than one pot at a time.

Other donors involved in stove pilots include USAID, Haburas, ETADEP and Permatil Foundations. Most NGO-installed stoves are mainly portable clay units powered by fuel wood and agricultural residues such as rice husks.

Solar

Many solar projects have been initiated throughout the country. These include solar community facility systems/solar power systems including installations on public community buildings to run electrical appliances such as television, DVD players and radios, solar pumps for bringing water to public taps and water heating systems.

Solar home lighting systems have been installed in private houses to run light bulbs at night and provide hot water. Portable solar lanterns and household hot water systems have also been piloted.

System capacities vary. For example, solar home lighting systems range from 10Wp solar module to 80Wp; enough only for household light at night. Solar power systems on public buildings such as clinics, village offices may have a capacity > 300Wps that can run electrical appliances and refrigerators.

Most install solar systems still work, however, many needs serious attention to maintenance in coming months. Field observations suggest some facilities are not properly operated and that unless proper operation and maintenance by users starts, then they will fail.

Wind

Although there are no current wind projects in Timor Leste, there is interest. The Alternative Technology Association has conducted a survey in Lequidoe and Aturo collecting wind data for future projects design. A similar study has been proposed for Oecusse District.

The Portuguese consultancy company EBIBA is conducting a renewable energy study including the potential for wind power. Commenced in August 2008, the study should be completed by June 2010. Sites surveyed include Laleia in Manatuto, Hoholau in Aileu, Lariguto in Viqueque, Kutulau in Bazartete in Liquica, Aiasa in Maliana and Triloka in Baucau.

Management models

Three management models deployed in energy projects were encountered during the survey: community based organization, institutional management and private management.

Community Based Organization

In a Community Based Organization (CBO) model the community manages energy facilities itself. Beneficiaries elect their representatives to sit in a management committee/group. The committee consists of coordinator, secretary, treasury and technical person. This executive team works closely with both community members and their leaders. They report out once every three to four months. Community members have the right to monitor, give advice and audit when necessary. The goal is to make sure facilities are properly managed and that maintenance funds collected from the community is used transparently for energy facility upkeep.

Roles and responsibilities for committees are regulated with approval from local government after consultation with beneficiaries and other entities. This model was used by UNDESA for solar lantern projects in Atauro and Laulara. In addition, Alternative Technology Association (ATA) is also adopting the same management model for solar home lighting system in Besilau in Aileu District.

Some people may not perform their duties as expected because they are volunteers. To address this, it can be suggested the members of committee should pay a reduced monthly energy facility maintenance fee, by up to 50% of the total.

This management schemes also creates job opportunities for youth. Committees recruit local technicians to carry out maintenance when needed and in return the local technicians are paid \$2.00 for each site visit.

Institutional Management

Here energy facilities belong to the general public and community representatives are trained for basic daily operation and maintenance. External funds are needed for components when they break. For example, solar community systems installed in schools are the responsibility of the Ministry of Education; community facility solar systems on sub district administration offices and village offices are under Ministry of State Administration's control; solar power system on clinics are responsibility of the Ministry of Health.

The model is often criticized as sometimes it is not possible to get responsible ministries to repair broken equipment.

Private Management

A private management model was encountered in Railaco, where more than 860 solar home lighting systems are managed by one Australian volunteer. Systems are installed and delivered to communities after they pay an upfront fee of US\$ 10 plus another US\$10 for yearly maintenance. Local people are hired and trained to monitor equipment and do basic repairs when necessary.



OBSTACLES TO SUSTAINABILITY

Across the communities surveyed, there was a clear message that community involvement and participation in project implementation is minimal. Time is rarely made available to build and transfer a strong sense of ownership among beneficiaries. Concerns over sustainability of projects were widely expressed by people and organizations. People put a question mark against whether current initiatives are it sustainable and able to make a significant impact on peoples lives.

The main problems found during the community assessment were:

- ***Energy installations in public buildings are not maintained:*** For example, a solar module was installed to run radio communication and lights does not work and the community does not have anyone who knows how to repair it. And even if they did, the money to make repairs should come from the responsible government ministry, which is not forthcoming.
- ***Lack of understanding about energy installations leads to misuse:*** For example, community members may use a home installation designed to run 5 light bulbs to run a television and DCD player, over capacity. This is because there is no appropriate information delivered to households on operation and maintenance.
- ***Volunteerism doesn't work:*** It is hard for community members to work on a voluntary basis to manage energy facilities in their villages; there is not time to spare for activities that do not generate income.
- ***A lack of standards and guidelines results implementing poor quality systems with communities:*** For example, different models and technologies introduced by different organizations cause confusion. Cheap materials reflecting low standards are sometimes delivered because there are no guidelines for donors and aid providers to use. To illustrate, fuel efficient stoves introduced have broken after a month of use and people feel they can better rely on traditional technologies.
- ***Communities in rural areas do not have access to service providers and suppliers of spare parts:*** In one village visited, >10 charge controllers are broken and community members do not know where to repair or buy new regulators. In another project that installed >600 solar panels on roofs, none work as spare parts are not available in Dili.
- ***Complicated technology is difficult for communities to maintain:*** For example, a solar home system controlled automatically lasted for only 1.5 years. The community did not have access to spare parts and could not make repairs by themselves because the system had an integrated components design. If one component fails, the rest need to be replaced too.
- ***Social aspects and a sense of ownership are ignored in projects:*** Without sufficient mobilization taking into account social norms, the likelihood of an energy program failing increases especially if projects do not convey a sense of ownership.
- ***Lack of data and information:*** In Timor Leste this problem is faced by many organizations with negative impacts on ill-prepared energy projects. Data are required pertinent to the system being installed, for example, on solar radiation, rainfall average and wind speed.
- ***No proper coordination channel for locals when they face problems:*** in some sustainable energy projects and systems installed in rural areas, there has been no effort to ensure that capacity to operate and maintain systems has been passed on to the user community
- ***Complete absence of any access to finance for enterprise development in the energy sector:*** This is a major gap. The presence of a dedicated agency for financing sustainable energy projects for productive use can be a key step to enhance energy – based rural entrepreneurship in Timor Leste.



STEPS FORWARD

Two issues are clear. First, energy poverty is a fundamental need for communities across Timor Leste. It is not going to be addressed in the short term by expansion of the electric grid, and on the long term the grid will still fail to span the country. This necessitates energy independence via community based energy solutions, particularly the primary needs for lighting and sustainably supplied cooking fuel. The lack of each has significant social and environmental costs. Working adults have constrained livelihood opportunities; school children have limited time for study; opportunities for better community cohesion are lost because community buildings are left in the dark; time is lost in the search for firewood; household health suffers from use of open fire for cooking. Environmentally, foraging for firewood has huge ecological costs. Forests are degraded and slopes are eroded worsening landslides and forest fire. There is a “tragedy of the commons” where Timor Leste’s landscapes are unmanaged and put to multiple uses with demands that exceed capacity to recover. This is particularly the case near Dili, where the urban center represents a market for wood, met by destroying mangrove and hence fish stocks, the hills which fire and blacken more with each passing year.

The second issue is that whereas the problem of energy poverty is widely recognized, response has been limited to small pilot projects that fail because:

1. In implementation there is often little community buy-in.
2. They are conducted at scales that are clearly unsustainable after project funds dry up.
3. There is failure among donors and NGOs to come up with energy solutions with similar designs and back up supplies of spare parts.
4. There is a lack of integration among projects and a failure to link energy poverty with environmental.
5. There is over-emphasis on community members volunteering time – this has failed and the need for trained, paid technicians able to install and maintain equipment has not been addressed.
6. Projects are donor driven – they fail to harness private sector and microfinance tools that could facilitate an economically sustainable model for addressing energy poverty.

Mercy Corps recommends a convening of donors and international NGOs, government, community leaders and the private sector to set a direction for addressing energy poverty for communities likely to be left of the grid. Three themes will be addressed:

1. Business models for financing and sustaining energy poverty solutions.
2. Standards for equipment and community mobilization.
3. Job creation in alternative energy solutions and fuel wood planting.

At this convention these themes should be developed into action points that different parties, in concert can develop into a *business plan*.

Business models for financing and sustaining energy poverty solutions

Issue:	Banking and microfinance are limited in scale and geographic scope in Timor Leste. To sustain markets for alternative energy products, access to credit from microfinance mechanisms is needed.
Action point:	<i>Develop and define microfinance mechanisms for energy products understanding the scope and actors available in Timor Leste.</i>

Issue:	Value chains that encompass energy demand across Timor Leste will need collaboration between the private sector, donors/NGOs and governments to form effective and mutually supportive business units.
Action point:	<i>Form business units around specific energy products and/or geographic coverage.</i>

Issue:	There is little competition in the market for renewable energy entrepreneurs who would like to set up shop in Timor Leste. For example, Baucau, the second largest city in Timor Leste, is an ideal location to set up such a business. Products that would potentially sell well here include: small solar home lighting system, portable solar lanterns, portable lights which can be recharged by a generator or PV system, windup (manually-operated) mobile phone chargers, small 12V DC ceiling fans, and possibly even 12V DC or three-way fridges if these could be made small enough and cheap enough.
Action point:	<i>Define strategies for business training, startup and development, with a particular focus on youth.</i>

Issue:	Energy products will likely need to be imported. Import costs need to be kept to a minimum to ensure cost-effective implementation of an energy poverty strategy.
Action point:	<i>Establish a government working group to ensure facilitation of business development.</i>

Issue:	Carbon markets are increasingly interested in developing country involvement; green energy markets and carbon credits may have the potential to contribute to financing an energy poverty plan.
Action point:	<i>Form a team that will investigate and capitalize on opportunities for green energy investors and carbon market support.</i>

Standards for equipment and community mobilization

Issue:	The diversity of pilot projects that have been attempted in Timor Leste have provided a foundation to understand what mobilization techniques have worked, and which have failed.
Action point:	<i>Define a common methodology agreed for socializing energy solutions to communities and budgets and introducing universal technologies.</i>

Issue:	Equipment standards among projects have varied and caused confusion among energy actors as to which are useful and which are not.
Action point:	<i>Develop a recommended list of energy projects, with suppliers, import costs and other factors impacting value chains, with the intention of using listed products in business plan implementation.</i>

Job creation in alternative energy solutions and fuel wood planting

Issue: Fuel wood planting will reclaim degraded landscapes, with agricultural and human security benefits, in addition to job creation.

Action point: *Define with government officials, donors and forest extension officers a coordination strategy for an agroforestry program developing fuel wood for community self sufficiency and commercial sale.*

Issue: A need for technicians trained in equipment installation and maintenance is needed to ensure a long shelf life for installed energy solutions.

Action point: *Develop training centers on alternative technologies and business development for youth.*

Issue: Training in rural areas is needed and it is unlikely that community members would have the resources or time to travel to urban centers for training, once inspired to do so.

Action point: *Build a mobile education/training center for schools and rural communities on the impact of using alternative technologies.*

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