FY2005 CDM/JI PROJECT FEASIBILITY STUDY

CDM Project Activities in Laos: Eucalyptus Plantations and Use of Biomass Energy

THE REPORT SUMMARY

Oji Paper Co., Ltd.

1. Background factors of the project activities

1.1. The background and overview of the project

In the subject country, Laos, the destruction of forest areas by excessive slash-and-burn shifting cultivation has been one of the main issues. However, due to the limited national budget and geographical factors, such as inland location, it is difficult to raise domestic or foreign capital investment. Furthermore, neither a recovery nor an increase of forests can be foreseen because the local habitants still rely on slash-and-burn farming.

This study aims to create an A/R CDM Project Design Document on the industrial plantation that has already launched for pulpwood as a CDM project. A document concerning a new methodology is currently being prepared by us and will be submitted to the PDD.

The project entity, Oji Lao Plantation Forest Co., Ltd. (LPFL, hereafter), is also our local counterpart for this study. It was established in 1999 as a joint company funded by a New Zealand company and the Laotian government. It has a 50-year concession for 150,000 ha in Khammouane Province and Borikhamxay Province in Laos and holds an allotment for 50,000 ha of plantations.

We, Oji Paper Co., Ltd., took over the LPFL stakes from the New Zealander company and found that the investment's profitability would not be sufficient unless CERs can be acquired by operating it as a CDM project. We are currently establishing a framework for an immediate start of a full-scale plantation of 7,000 ha per annum.

This study also aims to determine the feasibility of biomass-fuelled electricity power generation using wood residue from the plantations as a CDM activity and to create the project design document. Shrubs are usually burned in plantation preparation, but can be reused. There will be a good amount of unused biomass by combining the shrubs and post-harvest wood residues. Part of the subject area of the project has not been electrified yet and the villagers rely on diesel-powered mini-grids. We will consider the effective use of unused biomass and emission reduction of CO2 by a change to a small-scale biomass power plant with unused biomass for electricity generation.

1.2. Overview of the host country and the project area

The host country, Lao People’s Democratic Republic, is a land-locked country that is bordered by China, Vietnam, Cambodia, Thailand and Myanmar. Its total land area is 23 million ha, which is

approximately equal to Japan's mainland area. 80% of the area is mountainous, from the northern part to the central part, with altitudes of between 1,000m and 2,000m. In the remaining 20% of land area, there are plateaus with altitudes of less than 200m or river plains of the Mekong or its branch streams. The project area lies along the Mekong River and the area for plantations are flat with inclinations less than 10% at a height of 100m to 200m above sea level. The River Mekong flows 1,900km in Laos and serves the local economy as a water resource and a fish resource, as well as for transportation. However, the Khon Waterfalls near the Cambodian boarder prevent transportation abroad.

The climate has two noticeable seasons; a rainy season and a dry season. during the middle of April, it begins to rain and continues until mid-October. In the project area, the annual rainfall is between 2,400mm and 2,900mm. This is the area of greatest in Laos. While there aree floods in the lowlands along the River due to heavy rains, the dry seasons may bring drought. The whole country is within the tropical/monsoon climate zone. As a result, the temperature is high in the lowlands in the south and less in the mountainous areas of the north. The climate is mild in the project area where the annual average temperature is 24 to 29 degrees Celsius.

The soil in the project area contains mainly red-yellow podzolic (Acrisols), which is typical in areas in Asia where Eucalyptus and Acacias is planted.

During the 1970s, forests (tree crown densities of more than 20%) used to cover 70% of the total land area in of Laos. However, there was an outbreak of slash-and-burn shifting agriculture due to the natural increase in population, as well as the refugees from the the war in Vietnam. This has been degrading and decreasing the forests. By 1992, the forest area had declined to 11,168,000ha, which is 47% of the nation's land area. By 2002, it had shrunk to 9,825,000ha, which is 41.5% of the nation's land area. In other words, 1.3 million ha of forest areas were lost in ten years.

Forest accounts for 40,000 ha of the 150,000ha in the project area. The forest consists mainly of mixed deciduous woods, such as *Tectona grandis*、*Pahudia cochinchinensis*、*Terminalia nigrovenulosa*, and partly dry depterocarp woods, such as *Shorea siamensis*、*Dipterocarpus intricatus*、*D. tuberculatus.*

About 90,000 ha are the latent woods (i.e., bamboo woods, deserted woods, grasslands). The degraded forests are mainly covered by shrubs such as *Cratoxylon prunifolium.* The rest of the project area, 20,000 ha, is used for farming, residences or non-vegetation area. The project area is adjacent to two national reserves areas.

In Laos, they depend mainly on forest woods as energy resources. 57.0% of the consumed energy resources are firewood, while charcoals are used only in the urban areas. Both electricity and charcoals account for 11.7% each of the total consumed energy. The use of fuel oil has declined since 1977 as diesel powered generators have been replaced by hydroelectricity (although automobile usage is expected to increase in the future). With regard to electricity, large/mid scale hydropower plants account for 96.3% of power generated. This becomes 97.2% if small/micro scale

plants are included. Diesel-powered generation of electricity accounts for 2.7% of power plant capacities.

General information of Laos and its economic climateappears below:

General Information
Population: 5,609,000 (as of March 2005, the third Census)
Capital city：Vientiane
People： Total 49 ethnic groups including Lowland Lao (60％)
Language：Laotian
Religeon：Buddhism

Economic climate
Major industries ：Agriculture, Engineering, Forestry, Wood processing, Hydroelectricity
GDP/person ：USD 310（2003）resource: Japan ASEAN Centre
GDP growth：6.0％（estimated for 2005, resource: World Bank）
rate of increase in consumer price index ：10.5％（estimated for 2005, resource: World Bank）
Currency ： Kip
Exchange rate ：1USD =10,800kips（as of August 2005）

1.3. Policies and circumstances of the host country on CDM/JI: Criteria for CDM/JI, DNA assignment

The host country has authorised the Kyoto Protocols as of 6th of February, 2003 and assigned the Science, Technology and Environmental Agency (STEA) as a DNA. STEA reports directly to the Prime Minister's Office. Supported by Netherlands Development Organization (SNV) as an advisor, the preparation for the criteria to accept the CDM is expected to proceed rapidly.

1.4. Contribution for sustainable development and technical transfer to the host country

The paper materials business experiences a strong demand and the plantation business is a sustainable industry. The sustainability is expected to increase with this project, which provides the locals with environmental and financial benefits, recovering forests and generating employment.

This biomass-fuelled CDM project addresses regional sustainable development, installing a woody biomass power plant in the unelectrified village for which there is no plan to access the national electric system. In contrast to solar or wind power plants, woody biomass can provide electricity steadily throughout the year. The electricity will be distributed via networked cables, so that the network can be connected to the national system if it comes to the village.

We have been operating similar plantation businesses in many areas of the world and possess sufficient know-how for paper material plantations. It may be noted that we have an in-house Forest Research Institute, which has been studying Eucalyptus breeding. This proposed project will bring in

such skills and technologies, know-how, and genetic resources for transfer to the appropriate organisations, such as Laotian forestry institutes.
We can conclude that it is feasible to transfer and disseminate the technology in the areas where no plan for electrification when the facilities and profitability system is well prepared.
The project also provides the local residents with technical support for stationary farming and plantation operation by themselves so that they can abandon slash-and-burn shift agriculture. This will further counteract forest degradation and decay.

1.5. Research organisations

We have assigned the two expert organisations in Japan that appear below. Also, our local group company, which operates plantations in Laos, is commissioned to support the field research as a counterpart.

1.5.1. The organisations in Japan and the roles

Mitsubishi Research Institute Inc., (Outsourced)
Satellite Data, GIS Data, Studies of baseline and monitoring methods for the field research data
Studies of calculation methods for GHG emission and sinks
Supporting PDD creation
Supporting the unused biomass deployment project feasibility study
2
ChuoAoyama PricewaterhouseCoopers Japan (Outsourced)
Reviewing “Environmental and other indirect impacts research” by the local counterpart, Oji Lao Plantation Forest Co., Ltd. as an experienced analyst

1.5.2. Local organisations and their roles

(Local counterpart)
ＬＰＦＬ （Outsourced）
Environmental and other indirect impacts research
Operations support for arranging appointments with officials, manpower, interpreters, etc.

2. A/R CDM Project framework

2.1. Setting the project boundary

The subject area, for which LPFL is planning the CDM project plantation, will be selected according to the land-use classification of the Laos government; “farm” that is available for plantations, “deserted woodland”, “grassland”, “burned field”. Then, by agreement with the local residents, a land lease contract will be signed by the Laos government. Based upon “the procedures to define land eligibility” approved at EB22, part of the subject area exceeds the forestry threshold defined by the host country and may not be appropriate as a CDM project.
Therefore, this project will set a boundary for the plantation area according to the procedures to

define land eligibility of the sink project. The data used for the boundary setting were satellite data (Landsat/TM, ETM+), which were collected near the base year and before the project began. Land covers, evaluation of land-use, and setting of the project boundary were established based on the ground truth data collected from the field survey and geographical information data (GIS). As a result, 29,050 ha out of 50,000 ha were selected as the A/R CDM project area.

2.2. Selection of the baseline scenario

The areas for plantations by LPFL are mainly lands degraded by slash-and-burn farming, as previously mentioned and spontaneous second-growth is hardly expected. In addition, the inhabitants do not have steady incomes and must continue to rely upon slash-and-burn agriculture. In 1999, a New Zealand fund invested in a plantation business. However, it was difficult to maintain the business due to low profitability. The baseline scenario selected was based upon the assumption that the forest will not regenerate ecologically and financially in the future unless the project is not operated. In other words, the status quo is the baseline and the carbon stock change in the scenario is set to nil.

2.3. Demonstration and Assessment of Additionality

Based upon the tool for the demonstration and assessment of additionality approved at EB21, the demonstration and assessment of this project's additionality was tested as outlined below. The result shows that this proposed project complies with the forestry policy and CDM policy of the Laos government and with the laws of the land and the laws of forestry. Also, the result indicates that the local inhabitants in the subject area continue to practice illegal slash-and-burn farming and the spontaneous recovery of the forest cannot occur due to the land degradation. The alternative scenario, "keeping the current non-forest" land-use will not be prevented by any of the barriers.

Step 1 Identification of alternatives to the project activity that are consistent with current laws and regulations

Sub-step 1a. Definition of the alternatives to the project activity.

Scenario 1: The host country or the local inhabitants begins environmental or industrial plantations

Scenario 2: Industrial plantations are begun by a private/foreign funded company.

Scenario 3: Spontaneous recovery of the forest

Scenario 4: This project scenario, CDM industrial plantation begins by a private/foreign funded company.

Scenario 5: The current non-forest is kept.

Sub-step 1b. Enforcement of applicable laws and regulations: the law of forestry, etc

Sub-step 1c. Selection of the baseline scenario: Scenario 5 is selected.

Step 2 Investment analysis: Investment comparison analysis by IRR to select Scenario 4

comparing Scenarios 2 and 4.

Step 3 Barrier analysis

Sub-step 3a. Identification of the barrier that would prevent the implementation of the proposed project activity-

- Investment barriers
- Technological barriers
- Institutional barriers
- Barriers due to local ecological conditions

Sub-step 3b. Indication of at least one of the alternatives (except for the proposed project activity), which are not affected by the identified barriers: Scenario 5 is not affected by any of the barriers.

Step 4. Impact of CDM registration: Alleviation of country-risk, such as policy changes, alleviation of fire risk by local plantations with technology transfer, promotion of forestry policy by the government

2.4. Monitoring methodology

In order to comply with "Approach 3" of IPCC-GPG, we have examined monitoring methods and sampling methods, and collected data for each item monitored throughout the project period. The methodology that is currently being developed by our company will be applied to this project.

Stratification and sampling

Stratification for plantations will be done using the field survey results, satellite data and GIS data. Each stratum will be further sub-stratified according to the plantation schedule.

Defining a sampling size by the optimum allocation method and the sampling plots will be distributed using random numbers and topographic data in random order.

Monitoring of the baseline

Unless this project is implemented, illegal slash-and-burn farming will be continued by the locals, who have no other means to secure food. There is a period when shrub biomass increases, but the amount hardly changes in total. Therefore, the net GHG removal is set to nill in the baseline and there will be no fixed plot to represent the baseline for monitoring. Alternatively, satellite image data for the project area and the neighbourhood will be taken regularly and the shrub areas will be monitored.

Monitoring of the project

The above/below-ground biomass will be monitored for carbon pools. The biomass decrease by site preparation, machinery use, vehicle use for seedling transport, fossil fuel consumption by tractors for

logging, and nitrogen fertiliser are assumed to be emission sources.

To assure greatest accuracy, monitoring will be undertaken by the satellite data biomass amount estimation method and the measured weight of the shipped wood, as well as by conventional measurement of plots.

Monitoring of leakage

Vehicles, machinery used for the project outside of the boundary, consumption of fossil fuels and electricity for chip processing and the like, and the amount of used nitrogen fertilisers will be monitored.

2.5. The period of the project and CERs

The period of the project is thirty years, as is the CERs acquisition period. The profitability and the growth of the plantation woods will be studied with regard to a continuous plantation business after the 31st year.

The type of CER is tCERs.

2.6. Estimation of GHG reduction by project activity

Baseline carbon sink

Carbon stock change is set to nill in the baseline as described in 2-4

Estimation of the actual amount of pure carbon sinks

Carbon sinks by plantation woods were calculated by the stock change method. The growth of the plantation woods were estimated by applying the test plantation wood to the existing model. Other necessary coefficients were taken from GPG.

Fossil fuels for vehicles and machinery, fertilisation, and biomass disposal for land preparation are assumed to be GHG sources. The amount of biomass in the plantation area was derived from the field survey.

The total pure carbon sink in the project period of 30 years is calculated as 1,279,729 tCO2.

Leakage

The use of vehicles and machinery outside of the boundary, fossil fuels and electricity by the chip mill are assumed to be leakage sources.

The total leakage in the project period is calculated as 159,519 tCO2.

GHG emission reduction by anthropological activities

this is calculated as 1,120,210 tCO2 of GHG to be removed by the project activity.

2.7. Environmental impacts and other indirect impacts

The project has already begun and the research studies of environmental and social impact have been conducted. In addition, we assigned an environmental consultant for additional research on

environmental and social impact, and commissioned ChuoAoyama of PriceWaterhouse Coopers Japan for re-evaluation. The results are as follows.

2.7.1. Environmental impact

Hydrospheric / Regospheric impact

The plantations are scattered over a large area, considering the native ecosystem and distribution of local employment. No impact on the Mekong watersheds is expected as it is planned for the downstream sites of two National Protected Areas (NPA), Khammouane Limestone and Nam Kading, locating in the lowland side of the upper Mekong.

However, the Laotian government is planning the construction of a dam in the upstream of the plantation area. Large developments, such as that, might have a severe impact.

A dam will not only have a direct hydrospheric impact on the river basin outside of the boundary, but also indirect impacts on the ecosystem. Local farming and fishing have to be considered and monitored.

Aquatic pollution

The large-scale development in the upper area and around the project boundary might cause the incursion of sand and aquatic degradation

. The plantations are scattered and adjacent to the local farms, communes, Mekong banks and/or swamps. The project entity, LPFL, has environmental guidelines and operation and management manuals for appropriate use of fertilisation and agrichemicals. They will give sufficient consideration to the impact on natural habitats of aquatic species and will prevent the pollution of household water, agricultural water, river water, and groundwater.

Soil structure/fertility

Both inside and outside of the boundary, there is a problem of degradation of soil fertility and land deterioration due to the conversion of forest to farmland by the conventional slash-and-burn shift farming and illegal logging. The erosion of topsoil by rainfalls in the lowlands and the slope lands has caused severe damage and the lands cannot be used for farming or plantations.

Biodiversity

This project observes a strict environmental guideline: 1) giving first priority to the ecosystem in the selection of plantation sites, then selecting the site from lands in a state of deterioration 2) minimizing the impact on the ecosystem during site preparation, forest road construction, applying fertilisers and pesticides, and logging. Therefore, no negative impact on the ecosystem (i.e., native habitats and native vegetation) is expected from the project operations, such as plantations or logging.

Illegal logging and slash-and-burn farming is still popular among the local inhabitants within the project boundary where not yet delineated, or outside of the delineated area. The native vegetation is

being lost in such areas. Sustainable forest management and its consequences must be disseminated to the local people through employment and the technology transfer brought by the project.

Waste management

This project operates a plantation over the swidden areas and leftovers of shrubs remaining from site preparation and wood debris generated by logging. This material will be reused by this project as biomass energy for power generation, instead of conventional disposal by burning.

2.7.2. Socio-Economic impacts

Land tenure

LPFL has prepared written criteria for site selection and land leasing procedures. These will assist implementation of the project and, at the same time, give adequate consideration to the environmental impact on soils and ecosystems, as well as to social benefits, such as employment opportunities and land use. At any time during the project, whether in delineation, planting, or logging, land tenure can generate conflict. It is necessary to let the local people have opportunities in which they can express their opinions and to attend briefings, rather than only the heads of the communes. This will lead to a more amicable operation while also protecting the locals' land rights.

Livelihood & Food security・NTFP

The local people in the project area with a concession of 150,000ha have a low standard of living. They survive by hunting and rice cropping, and on products by NTFP. Some sell works of rattan and bamboo, wood and bamboo materials, NTFP and tobacco, but basically they live on a subsistence basis.

The project entity will respect the local people’s current life styles, which are deeply involved with the forests and nature and the various benefits from which they enjoy. The entity will provide employment opportunities and profit, but also will maintain the natural and forestry resources for the locals within and without the plantation areas

Employment (quality and quantity)

There is no established industry established in the subject area and the employment opportunities, which the project provides, will contribute greatly to the local communities and economies. The quality of employment is valuable as it will foster the development of technicians and IT experts (e.g., GIS operation), trucks and machinery operators, and plantation management know-how and skills.

Social-infrastructure (hospital, roads, schools, etc.)

The local interviews conducted in eight villages in 2005 (Ecolao, 2005) show that the villagers' require medical facilities, , schools and roads.

The Laotian government requires the project entity to contribute USD50.00/ha of plantation area and it will provide social investment, such as medical facilities, schools and roads, taking the locals' desires into consideration.

Technology transfer

The major industries in Laos are agriculture, engineering and forestry. The proposed project is expected to foster and transfer management skills, seedling methods, and breeding skills for industrial plantations for paper materials, the demand for which is rising in Asia.

2.8. Comments from the stakeholders

The Laotian government recognises forestry regeneration as an issue of the highest importance and favours plantations as its efficient solution, as it can also attract foreign funds. The project operator should not exploit the government's favour but should always give good consideration for the local people

Having collected information of the past environmental issues and met the environment and forestry government agency and a NGO, we found that an environmental NGO had criticised mass afforestation of Eucalyptus in the past. However, each meeting revealed that this is commonly acceptable these days if forestry management is sustainable and takes into account the environmental and social impact.

In the interviews of the local people in two villages where plantations have already begun, the respondents gave positive responses and hope for the plantations. The counterpart commented that they hear misgivings in the villages where the plantation has not been launched yet. It means that an explicit explanation to the inhabitants and the operation is necessary, based upon the guidelines regarding environmental and social factors.

In the research of environmental and social impact by the assigned environmental consultant, eight villages in the project area were interviewed. We heard many complaints and negative comments about the project before we took over. The environmental consultant concluded his analysis with the following advice: "As regards impact evaluation, there is a significant amount of negative impact generated by this project. It mainly derives from lack of awareness of management policy and inadequate education of staff. Now Oji Paper has taken over the project and is establishing precise environmental guidelines by a new socio-environmental department to solve the past problems. The appropriate staff education will spread the management policy, environmental guidelines, and operation procedures throughout the organisation and most of the current problems will be settled."

We take into consideration this result of research into environmental and social impact and reflect it in the reform measures.

The environmental guidelines and an expert socio-environmental department's impact measurements were already established. We are at the stage of improving the guidelines for practical use, creating operation manuals and a thorough educational program, and organising the framework so that the management policy, the guidelines and operational procedure can be spread throughout the

organisation.

3. A/R CDM project implementation

3.1. The Project's Implementation Structure

The plantation, which is proposed as an A/R CDM project, has already launched and the basic implementation structure has been established. For A/R CDM operation, additional systems are required, such as monitoring and CER management.

3.2. Financial planning for implementation of the project

The budget for the plantation, which the project will be based upon, has been prepared. The A/R CDM operation will be incorporated into the budget. However, the additional cost is a small portion of the total plantation budget.

3.3. Cost effectiveness

As mentioned previously, the additional cost for the A/R CDM project operation does not account for a large portion of the total project. Its significance is that the more additional credit income the project brings, the bigger will be the cost effectiveness.

However, acquisition of the credits by the A/R CDM project (i.e., tCER and 1CER) requires future compensation and is worth less than other Kyoto Protocol credits (i.e., CER, AAU, ERU). The cost effectiveness is, therefore, not expected to be high.

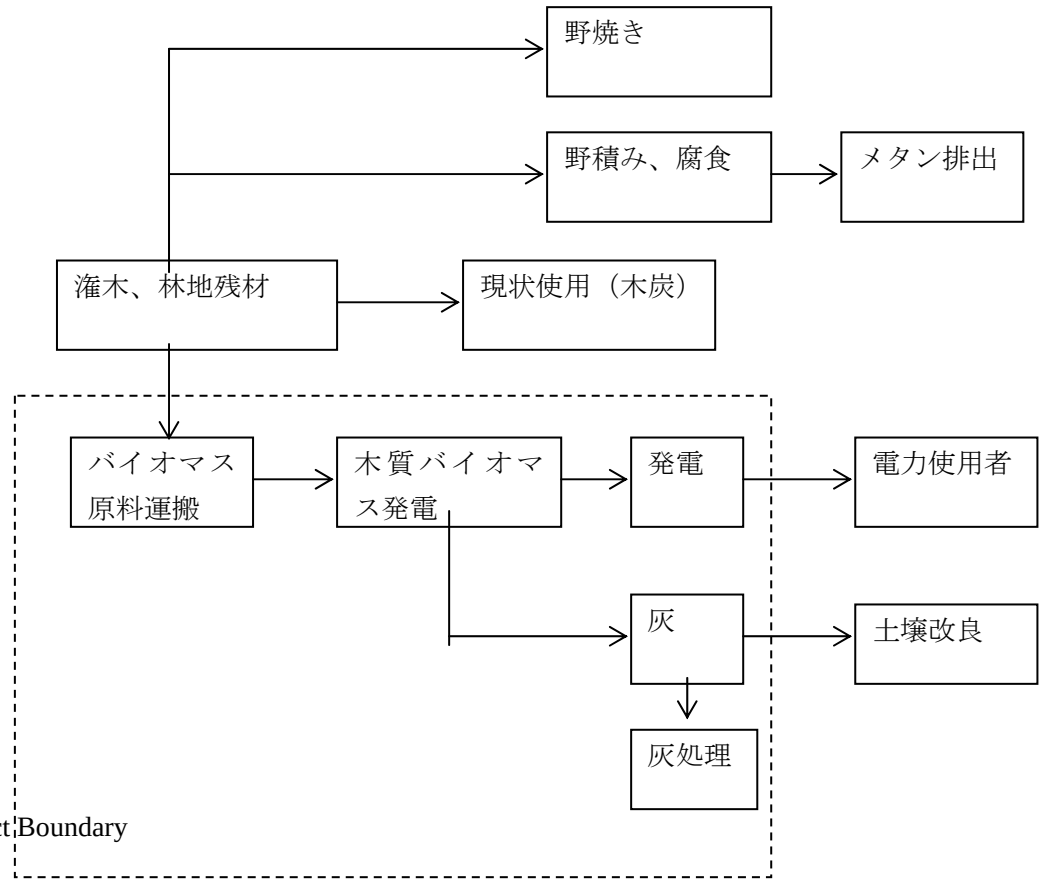
3.4. Prospects and issues of implementation

Despite the financial hardship mentioned above, we would like to implement this A/R CDM project in a scope of “Corporate Social Responsibility” by contributing to the sustainable development of the host country.

4. Planning of the Biomass Power Generation CDM Project

4.1. Setting the project boundary

The objective of this project is to install an independent woody biomass power generating system in an unelectrified village, Xang, where no future access to the national power system is planned. The size of the plant is 30kW and will run from 10 a.m. to 10 p.m. to provide electricity to houses, the medical clinic, the school, street lights and pumps for wells and irrigation. This project applies to the small-scale CDM project, Type I.A.; Renewable energy project (by the user/house). The project boundary is described below.



4.2. Selection of the baseline scenario

In the baseline, electricity output is calculated. For the simplified baseline, it will be estimated by multiplying the generated kWh by the coefficient of diesel power generation.

4.3. Demonstration and Assessment of Additionality

This project is to electrify the village where there is no access to the national power system. Obviously, diesel power generation will increase GHG emission unless biomass power generation is implemented. It matches the investment barrier and the simplified baseline and monitoring

methodology that are described in the CDM Guideline can be applied.

4.4. Monitoring methodology

In the case that the simplified baseline is based upon power generation, the measurement of the whole system, or the sample, will be monitored. The electricity generated at the power plant and the consumption by the users will be measured.

4.5. The period of the project and CERs

The crediting period is considered to be 14 years (2x7 years) for two main reasons. First, it is expected that the subject area will not have access to the national power system within fourteen years because there is currently no plan for electricity along the tributary areas of the Mekong River. Another reason is that a longer period is more economical in terms of depreciation of machinery. In the fifteenth year or later, it will be decided whether to continue the project as a normal power plant business, according to how durable the facility is and its profitability.

4.6. Estimation of GHG reduction by project activity

GHG emission in the baseline is calculated by multiplying the generated electricity by the emission factor of 50% load diesel generation. Today's PV system (SHS) provides 2 to 3 hours fluorescent lights (8W x 2) and one hour of a TV set (30W) by the 20W system. Daily electric consumption can be estimated as 78kWh/day.

The estimation is intended for a unelectrified area, but electrification will increase household consumption. The reported increase of electricity consumption in developing countries is due to longer use of lights and larger TV sets.

When the subject village is electrified, the daily consumption per household is estimated as 400Wh based on the use of fluorescent lights (10W x 2) and five hours of TV set use (60W). In addition, the electricity used by the medical clinic, the school, street lights and pumps for wells and irrigation are assumed to be as shown in the following table.

Daily electricity requirement by indoor facility

Facilities	Usage	Wattage	Duration	Power(kWh)
Medical clinic	Lights Refrigerator	10W×5 40L(30W)×1	5h 24h	0.970kWh
School	Lights Fans	20W×10 45W×5	10h 5h	3.125kWh
House	Lights TV set	10W×2 60W×1	5h 5h	0.400kWh
Street light	Lights	20W×10	5h	1.000kWh

Daily electricity requirement by outdoor facilities

Facilities	Usage	quantity	Length	Duration	Power(kWh)
Schools	Wells	3m^3/day	45～50m	4h	3.000kWh
		750W×1			
Reservoirs	Irrigation	100m^3/day	45～50m	6h	36.000kWh
		6kW×1			

The daily electricity consumption by the outdoor and indoor facilities is estimated as 178kWh, with an annual total of 42,788kWh

In the baseline, the power is used from 10 a.m. to 8 p.m. and the emission factor with 50% of the diesel power load is set at 1.3kgCO2/kWh for calculation. As a result, the annual GHG emission comes to 54t CO2.

This project has no GHG emission because it is a renewable energy project by biomass power generation. GHG emissions increased by transportation and machinery use for biomass fuels are excluded in this estimation because; 1) they are necessary to proceed the project, 2) they are not generated solely by the woody biomass power generator, and 3) The amount is not significant comparing to the baseline scenario.

The biomass power scale is negligible for the impact on charcoal sales and household usage.

The project assumes there is no leakage emission in emission reduction. The amount of emission equals the total emission reduction amount. Annual 54tCO2 will be reduced if the demand for electricity remains as it is today and will be 756tCO2 in total of 14 years.

4.7. Environmental impacts and other indirect impacts

We assume that detailed analysis of the environmental impact is not necessary because the scale of this project is relatively small in the biomass power generation domain, and the organisation of the project is simple.

As for socio-economical impact, electrification will increase electricity consumption per household as mentioned above. This matches the Laotian government's promotion for "Regional electrification by renewable energy" and can be considered as a contribution to sustainable development.

4.8. Comments from the stakeholders

There is a high demand for electricity. 10 households out of 44 are using diesel-powered electricity in Xang: 15 households have television sets. The diesel power is operated from 18:30 to 21:00. 15 households out of 31 rent PV systems and 9 households have television sets. The rental

cost of a 20W PV system is 30,000 kips/month, while a 40W system costs 60,000 kips/month. PV systems are not usable during the rainy seasons.

Car batteries are being used in many villages in Laos where there is no access to the national electricity system. Those batteries are brought to the villages, having been electrified with the national system, and must be charged from time to time. Battery charging is not expensive because 96% of electricity in Laos is generated by large or medium-scale hydro-powered systems and the charge is not expensive; between 113 to 765 kips/kWh (or JPY1.3-8.6/kWh). Therefore, in comparison to other developing countries/areas where mainly diesel-powered generation is used, electricity is inexpensive in Laos.

However, as there is no way to gain access to the subject area of this project, except by a small boat, batteries can not be carried frequently. Consequently, there is a high, constant demand for electricity from an independent source in dry and rainy seasons in unelectrified villagers.

5. Biomass Power Generation CDM Project Implementation

5.1. Implementation Structure of the project

As the scale is small, a business manager will be assigned within the plantation operation company to deal with this project. On implementation of the power plant, certification of it will be acquired separately from the plantation business.

5.2. Financial planning for the project implementation

Similar to the A/R CDM project implementation, the additional cost of this project is not significant in the entire budget.

5.3. Cost effectiveness

The cost of the facility has to be reduced for profitability in the power plant business. As the credit value is rather higher than the A/R CDM credit, the cost effectiveness of this project will be sufficient if the cost issue is solved.

5.4. Prospects and issues of implementation

As mentioned in the previous section, the cost of the facility has to be lowered. We will consider collaborative research and development with a manufacture of the facility.