CDM/JI Feasibility Study (FY 2007)

Feasibility Study on Rural Electrification by Utilization of Biomass in Lao P.D.R

Summary

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Chugoku Electric Power Co., Inc.

1. Basic Elements concerning Project Implementation

(1) Background and Objectives of the Project

Although developing countries are also coming to view global warming as a serious problem, the most pressing issue for these countries remains economic development, and they have deep-seated concerns that taking measures to counter global warming will hinder their own national development.

Accordingly, in order to encourage the vigorous efforts of developing countries, “Co-benefits CDM,” which aims to vitalize global warming countermeasures as stimulants to the sustainable development of developing countries while encouraging development assistance by advanced nations and encouraging the formation of low-carbon societies with low emissions of greenhouse gases, is an effective approach when thinking about Japan’s development assistance and international cooperation in global warming countermeasures in the future.

The target country of Lao People's Democratic Republic (Laos), which is a landlocked country in Indochina, is currently classed as a least developed country (LDC). In compiling the Sixth Five-Year Socioeconomic Development Plan, the Government of Laos has made it a top priority to “break away from least developed country status by 2020” and is conducting measures geared to realization of this goal.

The electrification rate in Laos currently stands at just 48%. In rural areas in particular, three out of 17 prefectures in the country have an electrification rate of no more than 20%. In contrast, the electrification rate in the capital of Vientiane, where 14% of all households are concentrated, is 90% indicating just how bad the situation in rural areas is.

To contribute to the said target of breaking away from least developed country status by 2020, the Ministry of Energy and Mining, which is the agency charged with promoting electrification in Laos, currently aims to increase the electrification rate to 70% by 2010 and 90% by 2020. However, since Laos comprises a lot of small communities dispersed over a wide area, it is difficult to promote electrification through extending the existing electricity infrastructure, and attention is being directed towards promoting off-grid electrification using diesel generators.

Moreover, in non-electrified areas, numerous cases can be seen where diesel generators are used to recharge batteries that are used for lighting and so on in households.

It can thus be seen that diesel generators are being used in order to provide off-grid electrification in rural areas and to conduct charging of batteries in non-electrified areas. However, because Laos is not an oil-producing country, fuel prices have always been relatively higher than other prices and this is a drawback to promoting electrification based on diesel generators.

Moreover, due to the recent worldwide inflation in fuel prices, fuel prices have reached even higher levels and the utilization of oil substitute energy in regional areas has become an important issue.

Concerning regional electrification utilizing fuel made from biomass, which is generated from the key industries of agriculture and forestry in Laos, the Government of Laos attaches high expectations and it would be beneficial to Laos if this could be realized as a CDM undertaking utilizing the advanced technology possessed by Japan.

(2) Outline of the Project

The project intends to promote rural electrification, which is one of the top priority development needs of Laos, through gasifying biomass made from agricultural waste in rural communities and utilizing oil obtained from jatropha, which grows naturally in Laos, as fuel (for mixed combustion) in a diesel generator.

The study in hand, targeting a pilot project in a non-electrified village in Xayabury prefecture in the north of Laos, investigated electrification utilizing biomass from the village's agricultural waste and jatropha growing in the village.

In addition, conditions regarding the utilization of biomass, etc. in the central and southern parts of Laos were surveyed and scenarios and policies (programs) for extending the outputs to approximately 6,500 non-electrified villages were examined.

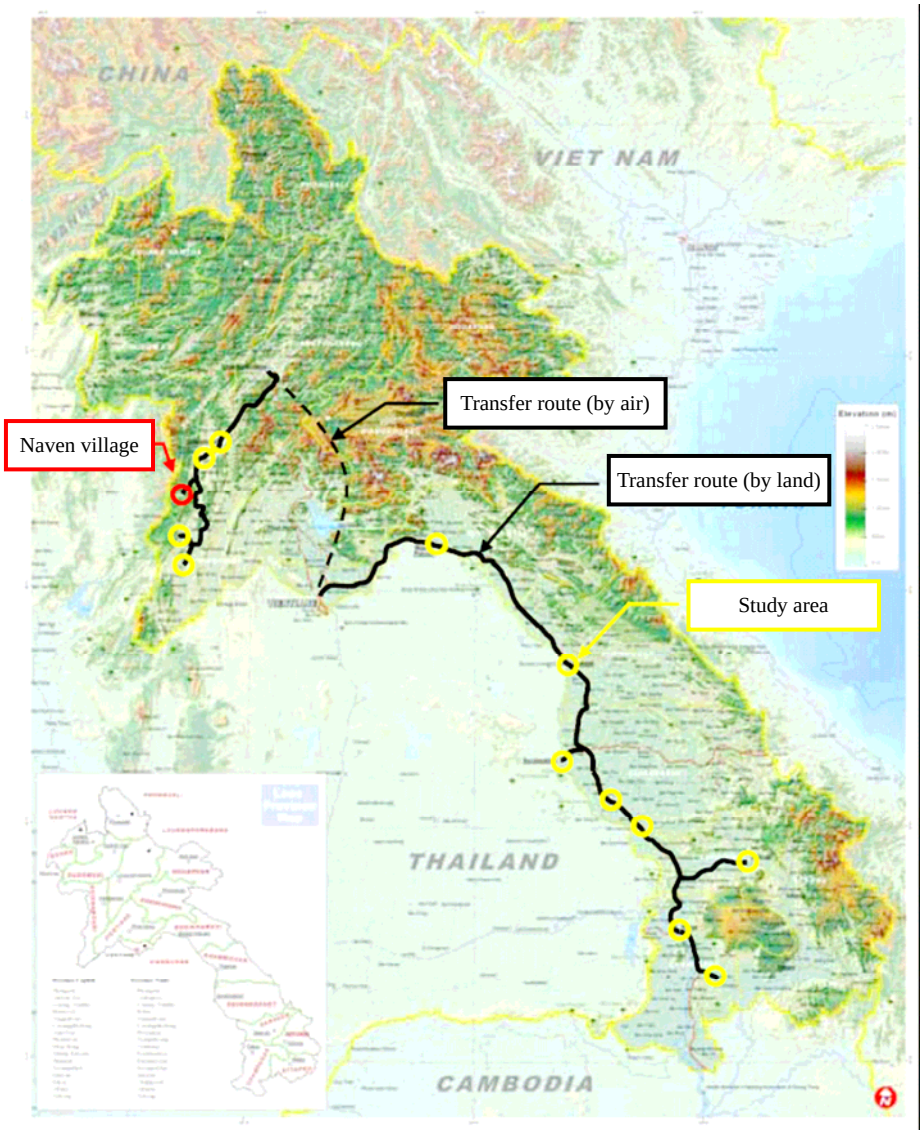

Figure 1 Map of the Pilot Project and Study Area
(Source: UNOSAT)

(3) Outline of the Host Country

Laos traces its history to the kingdom of Lan Xang, founded as the first unified dynasty of Laotians in 1353. This kingdom broke up in the 18th Century and Laos was incorporated into the protectorate of French Indochina by France, which was aiming to colonize Indochina at that time. Laos achieved independence from French rule in October 1953 based on a treaty between the two countries, however, civil conflict raged for a long time after this due to confrontation between the monarchy and military.

In the Indochina Peninsula, the United States launched bombing against North Vietnam in 1965, and saturation bombing was directed against northern parts of Laos and parts of the country along the Ho Chi Minh trail.

Following the end of the Vietnam War in 1975, the royalist government was overthrown and the present "Lao People's Democratic Republic" comprising a socialist form of government was established by the Lao People's Revolutionary Party.

In Laos, where single party rule by the Lao People's Revolutionary Party has continued ever since, policies are decided in the national Assembly that is held every five years.

In the 4th National Assembly held in 1986, the New Economic Mechanism known as the Chintanakan Mai (New Thinking) was proposed and the economy has since shifted towards a market economy.

(4) Approach of Laos to the CDM

Laos ratified the U.N. Framework Convention on Climate Change (UNFCCC) in January 1995 and the Kyoto Protocol in February 2003.

Currently, the Water Resource and Environment Agency (WREA) acts as the DNA and it is now preparing the final bill for the Decree on the approval procedure for proposed Clean Development Mechanism (CDM) project activities in Lao PDR.

Only one CDM project has so far been registered in Laos, however, the WREA plans to promote CDM projects and establish a DNA committee comprising the following members in cooperation with related agencies in the country.

Chairperson:	Director of the Water Resource and Environment Agency
Vice Chairpersons:	Deputy secretary of the Ministry of Foreign Affairs
	Deputy secretary of the Ministry of Finance
Committee members:	Deputy secretary of the Ministry of Planning and Investment
	Deputy secretary of the Ministry of Energy and Mines
	Deputy secretary of the Ministry of Agriculture and Forestry
	Deputy secretary of the Ministry of Transportation and Construction
	Deputy secretary of the Ministry of Industry and Commerce
Secretariat:	Water Resource and Environment Agency

(5) Contribution to Sustainable Development in the Host Country

The Government of Laos ranks the eradication of poverty as its most important policy. It has compiled and is implementing measures under the National Growth and Poverty Eradication Strategy (NGPES) and it aims to break away from LDC status by 2020.
Electrification of rural villages has been targeted as a specific activity under the NGPES, which aims to raise the electrification rate from the current level of 48% to 70% by 2010.
Furthermore, the Ministry of Energy and Mining, which is responsible for electrification policy, aims to increase the electrification rate to 90% by 2020.
However, since 80% of Laos is covered by mountainous land and comprises a lot of small communities dispersed over a wide area, the promotion of electrification through extending the existing electricity infrastructure is economically prohibitive. Accordingly, promotion of off-grid electrification using diesel generators is viewed as an important policy.

Meanwhile, Laos is not an oil-producing country and it relies on imports to provide all its fuel requirements. However, the worldwide inflation in fuel prices in recent years has had a devastating economic impact on non-electrified areas that possess no other fuel resources, and this has become a problem in terms of advancing electrification based on diesel generators.

Since this project aims to utilize biomass from agricultural waste generated in non-electrified villages as the source of energy in generators, it will contribute to the eradication of poverty and sustainable development that is needed in Laos.

(6) Implementation Setup of the Study

The project study was implemented by Chugoku Electric Power Co., Inc. with Shimizu Corporation acting as the cooperating enterprise (see Figure 2).

Moreover, in implementation of the study, the National University of Laos (NUOL), which is the only general university in the country, and the Ministry of Energy and Mining, which is responsible for electrification policy, acted as the counterparts.

The National University of Laos was in charge of collecting general information and coordinating communications with related agencies, while the Ministry of Energy and Mining cooperated in implementation of the field surveys.

The Ministry of Energy and Mining has a strong interest in rural electrification utilizing biomass and it gave its active cooperation to the study.

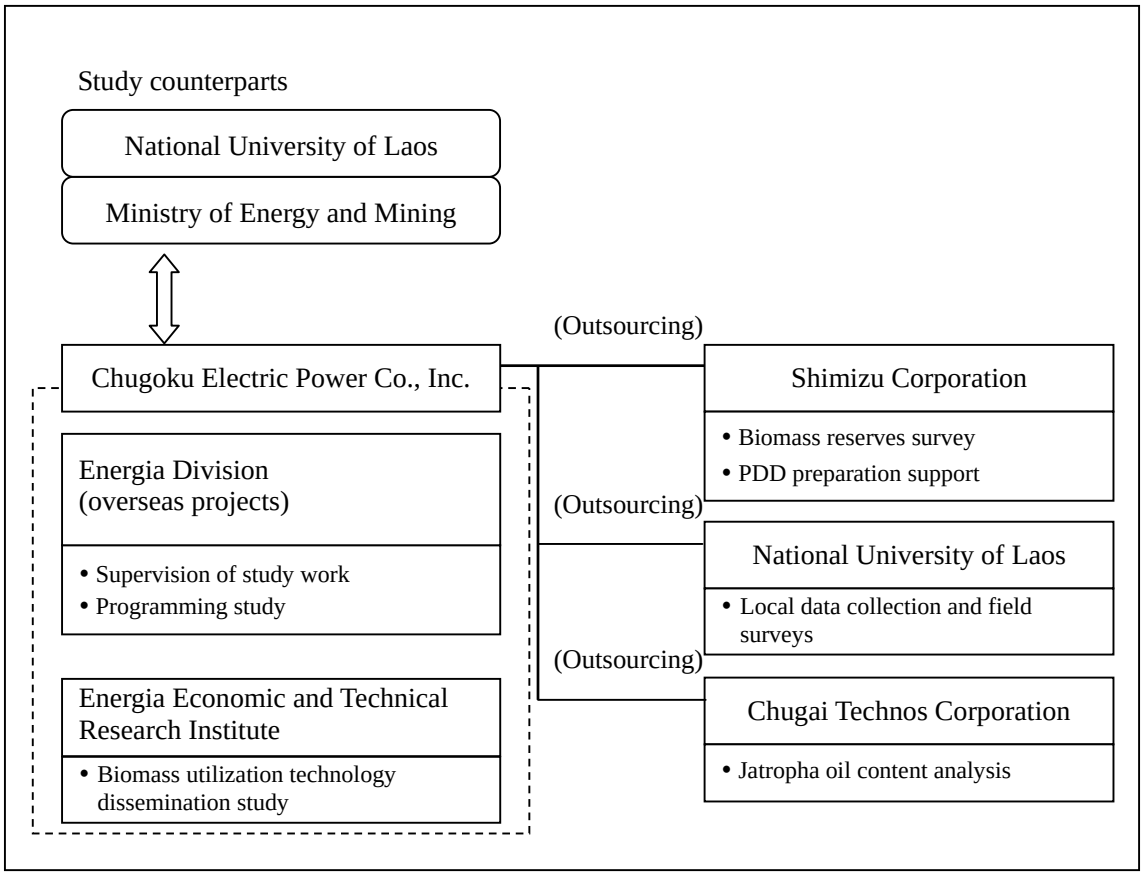

Figure 2 Implementation Setup of the Study

2. Project Compilation

The project intends to gasify biomass made from agricultural waste in rural communities and to utilize oil obtained from jatropha, which grows naturally in Laos, as fuel (for mixed combustion) in a diesel generator, and it aims to turn these activities into a program for extension to non-electrified areas all over Laos in order to promote rural electrification, which is one of the top priority development needs of that country.

Towards this end, the village of Naven in Phiang, Xayabury prefecture in northern Laos was selected as a pilot project, and a scenario for extending the activity to the whole country was examined based on the study findings in the central and southern parts of Laos.

(1) Outline of the Pilot Project Site (Naven Village)

Naven is a village that was formed through the amalgamation of three communities. As of June 2007, it had a population of 3,413 (577 households, 1,669 males and1,744 females) and the inhabitants make their living through farming mainly comprising cultivation of rice and maize.

Xayabury prefecture contains a trunk road (unpaved) that leads from Luang Prabang to the border with Thailand, however, Naven village is 28 km away from this road and it takes more than one hour to reach the village from the main road even during the dry season.

Two types of rice, that is seasonal rice and upland rice, are cultivated and production is sustained almost uniformly throughout the year except for a very short time. Meanwhile, maize production is concentrated into the period from September to November.

Jatropha is currently only utilized to provide hedges around households, however, cultivation geared to producing jatropha oil is not carried out at all (see Photograph 6).

Table 3 Agricultural Production in Naven Village

Type	Annual Production Quantity (t/year)	Cultivated Area (ha)
Seasonal rice	520	136
Upland rice	630	211
Sweet corn	180	44

Photograph 4 Naven village

Photograph 5 Rice paddies of Naven

Photograph 6 Jatropha used as a hedgerow

(2) Project Implementation Contents

Upon conducting assessment of the technical and cost aspects, it was decided to adopt diesel power generation (mixed combustion of biogas + light oil + jatropha oil) as the applied technology for the project.

In the pilot project, it is planned to install a 95 kW generator in the first year and, regarding the extension program, to successively electrify approximately 25% of the 6,000 or so villages throughout the country that are currently not electrified.

3. Project Boundary, Baseline Setting, Demonstration of Additionality

In the project, the small-scale methodology AMS-I.A. 'Electricity generation by the user' Version 12 shall be applied.

(1) Baseline Setting

As the baseline scenario, it was assumed that conventional diesel generators would be introduced to non-electrified areas based on the electrification policy of Laos.

(2) Demonstration of Additionality

Concerning the profitability of the pilot project, IRR in the case where revenue cannot be anticipated from the sale of CERs (certified emission reductions) is 8%. Therefore, when the country risk, etc. is taken into account, the project is not attractive for investment and has a low feasibility for realization.

(3) Project Boundary

According to AMS-I.A, the project boundary includes the physical and geographical locations of renewable energy generation facilities as well as the equipment that uses the generated electricity.

Accordingly, the project boundary with respect to the biomass gasification system includes the generators, gasification plant facilities and chaff stores, etc. installed in the village. Concerning the transportation of chaff, since it is assumed that the villagers will use rear cars and so on to do this, fuel consuming facilities such as rice mills and chaff moving facilities are not taken into account.

Moreover, in the case where diesel generation is carried out based on mixed combustion of biogas + jatropha + diesel oil, in addition to the above, a small diesel oil storage tank, jatropha oil pressing facilities and land for cultivating jatropha will be required. In this case too, it is assumed that materials will be transported through the manual efforts of citizens.

4. GHG Emission Reductions and Leakage Resulting from Project Implementation

(1) GHG emission reductions

As a result of calculating based on the conditions obtained from the study findings, GHG emission reductions during the credit period (2008~2021) are projected as 10,010 t-CO2.

Moreover, through turning the pilot project into a program for extension to non-electrified villages throughout the whole country, it is estimated that GHG emission reductions of approximately 1,900,000 t-CO2 can be achieved.

(2) Leakage

There is no leakage in the project.

5. Monitoring

In the project, the approved small-scale methodology AMS-I.A. 'Electricity generation by the user' Version 12 shall be applied.

6. Environmental Impact

This is a power generation project that will be implemented based on the Environment Management Standard for Electricity Projects that was issued by the Ministry of Industry and Handicrafts Electric Power Bureau (the present Ministry of Energy and Mining Electric Power Bureau) in 2003.

The said standard does not require an environmental impact assessment for projects where the generation output is less than 100 kW.

Since the pilot project targets small-scale power generation with output less than 100 kW, as a rule it is only necessary to submit an "Explanation of project contents."

Moreover, even if the project is turned into a program for national extension, since the generation capacity of individual projects will be less than 100 kW, it will not be necessary to implement environmental impact assessments.

7. Comments of Stakeholders

Laos does not have any rules for specifying the stakeholders of CDM projects. Accordingly, confirmation was carried out and consent obtained from the WREA (the DNA in Laos) regarding the stakeholders and method of collecting their comments for the pilot project, as well as the stakeholders and method of collecting their comments for the nationwide extension program.

(1) Pilot Project

Stakeholders in the pilot project are the citizens of Naven village, Phiang district which administers the village, and the Xayabury branch of the Ministry of Energy and Mining Electric Power Bureau.

Upon collecting comments from these stakeholders via interviews, it was found that they agree with the project and strongly hope for its early realization as something that will contribute to the eradication of poverty in the village.

(2) Extension Program

Stakeholders in the extension program are central government agencies (i.e. the Ministry of Energy and Mining and WREA).

The Ministry of Energy and Mining is currently working on raising the electrification rate from 48% at present to 70% by 2010 and 90% by 2020 with a view to eradicating poverty. Accordingly, the project conforms to the ministry's policy, and the ministry was found to be strongly in favor of its realization.

Also, the WREA is anticipating realization of the project as something that will contribute towards the eradication of poverty.

8. Project Implementation Setup

The most important thing in the project is dissemination based on the participation of citizens. Figure 7 shows the implementation setup (scheme proposal) for the project.

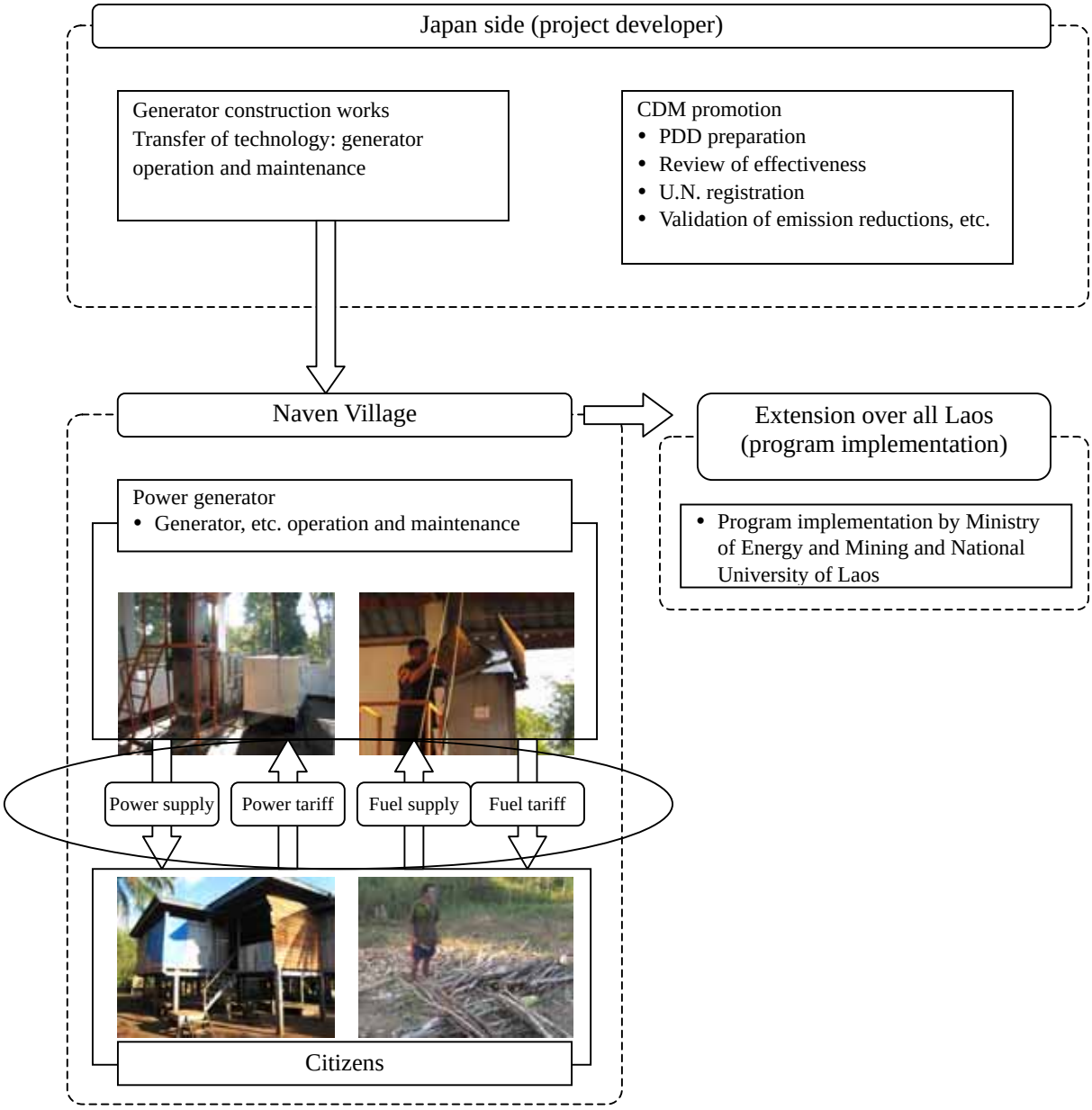

Figure 7 Project Implementation Setup

The implementing body for the pilot project is Naven village.

In the pilot project, it will be necessary to install a generator, however, because the village does not have the finances to pay for this, the project participants on the Japanese side will bear the whole initial investment.

Naven village will use the generator installed by the Japanese project participants to operate the power generating utility (fuel procurement, equipment operation and maintenance, power supply, collection of power tariffs, etc.) in the village.

However, since Naven village does not possess the capacity to operate the power generating utility, project operation shall be either conducted with cooperation from the National University of Laos or consigned totally to the said university.

9. Fund Plan

The funds required for implementation of the pilot project comprise the plant investment and running costs. Concerning the plant investment, since the project is a small-scale concern, direct investment by the project participants on the Japanese side is considered to be appropriate.

As for the running costs, the project will be operated based on revenue obtained from power tariffs in Naven village.

10. Project Economy

Tables 8 and 9 show the results of estimating the investment payback period and IRR in the pilot project and the extension program.

Table 8 Investment Payback Period

Calculation conditions		Payback period	
		Pilot project	Extension program
No economic value to CERs		10 years	Irrecoverable
Economic value to CERs	5US$/t-$CO_2$	9 years	14 years
	10US$/t-$CO_2$	8 years	13 years
	15US$/t-$CO_2$	7 years	11 years
	20US$/t-$CO_2$	6 years	10 years

Table 9 Internal Rate of Return

Calculation conditions		IRR	
		Pilot project	Extension program
No economic value to CERs		8.07	—
Economic value to CERs	5US$/t-$CO_2$	10.53	2.66
	10US$/t-$CO_2$	12.83	8.49
	15US$/t-$CO_2$	15.00	13.49
	20US$/t-$CO_2$	17.06	17.96

11. Issues facing Project Actualization

The project is a “Co-benefits CDM” aiming to promote rural electrification, which is one of the top priority development needs of Laos, through utilizing biomass made from agricultural waste in rural communities.

The study examined a pilot project in a non-electrified village in northern Laos and a program for extending this activity to the whole country.

Related ministries and agencies and local governments have a strong interest in rural electrification and place high expectations on the project’s realization.

However, the following issues exist regarding program extension, so it will be necessary to resolve these upon securing common awareness with the counterparts.

- Risk concerning the purchase price of biomass fuel
- Risk concerning fluctuations in the power sale price
- Legal and tax risks
- Project dissemination based on public participation
- Assessment of impact caused by long-term power generation using jatropha oil