FISCAL 2006 CDM/JI PROJCET STUDY
PROVISIONAL REPORT SUMMREY VERSION

SMALL SACLE HYDROPOWER GENERATION PROJCET IN SABAH, MALAYSIA

Hokkaido Electric Power Co., Inc.

1. Basic factors relating to implementation of the project

(1) Outline of the proposed project and background of the planning

○ Outline of the proposed project

The project, which aims to construct a run-of-river type hydropower plant, entails building an intake weir at 2 sites (Kimanis Kanan and Kimanis Kiri) on Kimanis River in the northwest parts of Sabah, Malaysia, and connects to the local grid to sell the generated electric power. Since the generated electric power is clean energy which accompanies no emission of greenhouse gas, implementing this project will be effective in achieving reduction of emission of greenhouse gas by utilising grid as a renewable energy to alternate fossil fuel.

Figure-1　Project Site

○ Background of the planning

Malaysian government formulated 'Best Mix Strategy through 5 kinds of energy for power source' in 1999 in the wake of concern over environmental issues and increasing dependence on natural gas which is limited in reserve. In the strategy, renewable energy was ranked 5th energy source after petroleum oil, natural gas, coal and hydropower (in large scale) its development and promotion are intended to carry forward aggressively. The State of Sabah also has a need for small scale hydropower generation, since more than 70 % of generated power is occupied by thermal generation which sources are diesel or natural gas. Moreover, soaring oil prices in recent years have been pushing the needs for development of small scale hydropower generation.

The project is possible to contribute to diversification power sources and reduction of environmental impact since it is a small hydropower generation project with 4MW of total generated output in the two project sites.

(2) Outline of the host country

The Malaysian economy recorded negative actual GDP growth of minus 7.4 % in 1998 due to the effects of the 1997-1998 Asian economic crisis; however, it recovered to show positive growth in 1999 by 5.8 % and further to 8.5 % in 2000. After this, growth rate slowed to 0.4 % in 2004 due to reduction of merchandise export influenced by global recession, however, thanks to the new economy policy focusing on expanding fiscal policy and encouraging consumption, it again recorded fast recovery up to 4.1 % in 2002. Since then, it grew 5-7 % annually during 2003-2005 boosted by high rise of crude oil and it is expected to grow up to 5.8 % in 2006.

In Malaysia, renewable energy sources such as solar, hydro, wind, and biomass have been planned to be promoted and in 2005, the government planned to introduce renewable energy sources to the extent up equivalent amount of 5 % of the total generation capacity. This plan was not realized then, however, the more reasonable and practical target of 350 MW is set in 'The 9th Malaysia Plan'.

(3) The policy regarding to CDM/JI, such as criteria for CDM/JI, acceptance and DNA establishment, etc.

○ Policy and conditions regarding CDM

Among countries of Southeast Asia, Malaysia has one of the most advanced systems for accepting CDM. Malaysia ratified the Framework Convention on Climate Change in July 1997, and Kyoto Protocol in March 1999. The Ministry of Natural resources and environment was assigned as DNA in September 2002, and the Malaysian government approved CDM criteria in August 2003.

The latest Information on Malaysian CDM criteria and authorization system can be obtained through the web site of PTM（http://www.ptm.org.my）which is a contact organization for CDM project in energy sector. Moreover, summery of that information in Japanese version is placed on the web site of Kyoto protocol information platform.

○ Current development

At the present time in September 2006, those CDM projects approved by Malaysian government are 15 in number and the 10 cases among them are registered in CDM Executive Board. 9 of 10 projects registered in CDM Executive Board are CDM projects which utilize empty fruit bunch.

As a result of hearing survey to PTM, it is found that just 1 proposal of hydropower CDM was submitted to PIN but there is no project yet which applies for authorization by the government. Thus, we had positive comments to require realization of the project.

(4) Advantages of the proposed project for the host country, in view of contribution to sustainable development or technical transfer

○ Advantage in contribution to sustainable development

① Development of sustainable energy

② Employment creation and local revitalization through construction and maintenance of hydro power plant

③ Spillover to other sites of hydro power generation in Sabah

○ Technical transfer

Techniques regarding to development, operation and management of run-of-river type hydropower plant

(5) Setup for conducting study

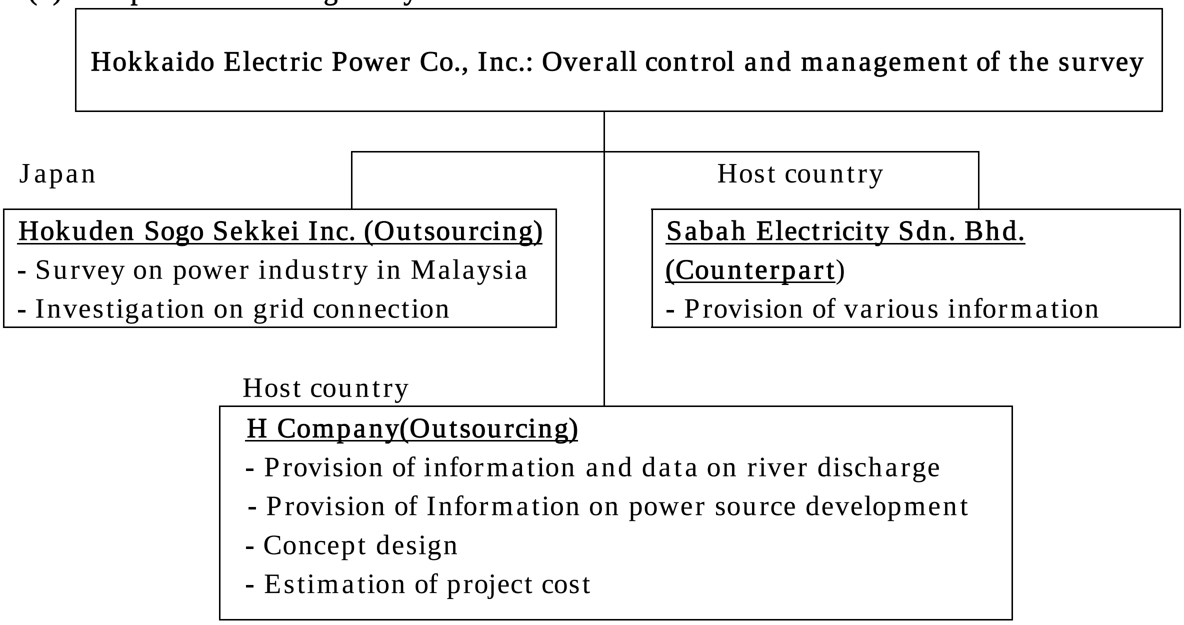

Figure-2 Implementation Setup of the Study

2. Panning of the project

(1) Specific contests of the project

In the survey, these matters were examined to formulate the generation plan.

① Route of channel at both Kimanis Kanan site and Kimanis Kiri site were planned using topographic map in the scale of 1/50,000.

② River discharge data, using the river near the project site, were obtained from the gauging station and examined.

③ Several site reconnaissance were conducted and river discharge, topography, and channel routes were confirmed.

④ Using those data mentioned above, the most suitable generation plan was examined. Concretely, determining the maximum discharge flow, calculation of head loss, selection of turbine type, calculation of turbine efficiency, and these results were taken into account to calculate maximum output and power generation.

⑤ Based on the results mentioned above, construction, operation and maintenance costs were calculated.

Table-1 shows the generation plan at both sites of Kimanis Kanan and Kimanis Kiri. In addition, Figure-3 shows an example of the route plan of channel at Kimanis Kanan site.

Table-1 Power Generation Plan Particulars

Item				Kimanis Kanan site	Kimanis Kiri site
		River name	—	Kimanis Kanan River	Kimanis Kiri River
		Catchment area	km^2	34	36
Generating plan		Power generation type	—	Run-of-river, conduit type	Run-of-river, conduit type
		Intake elevation	m	213	85
		Outlet elevation	m	76	15
		Total head	m	137	70
		Effective head	m	124	63
		Maximum discharge	m^3/s	2.5	3.0
		Maximum output	MW	2.5	1.5
		Electricity generation	MWh	15,400	8,600
		Maintenance flow	m^3/s	0.1	0.1
Equipment outline	Intake weir	Type	—	Concrete gravity type	Concrete gravity type
		Height	m	4.0	4.0
		Dam crest length	m	35.0	35.0
	Channel	Penstock	m	L=4,600, D=1.40	L=3,200, D=1.60
		Discharge channel	m	L=600, D=1.20	L=500, D=1.40
		Turbine type	—	Francis Turbine	Francis Turbine

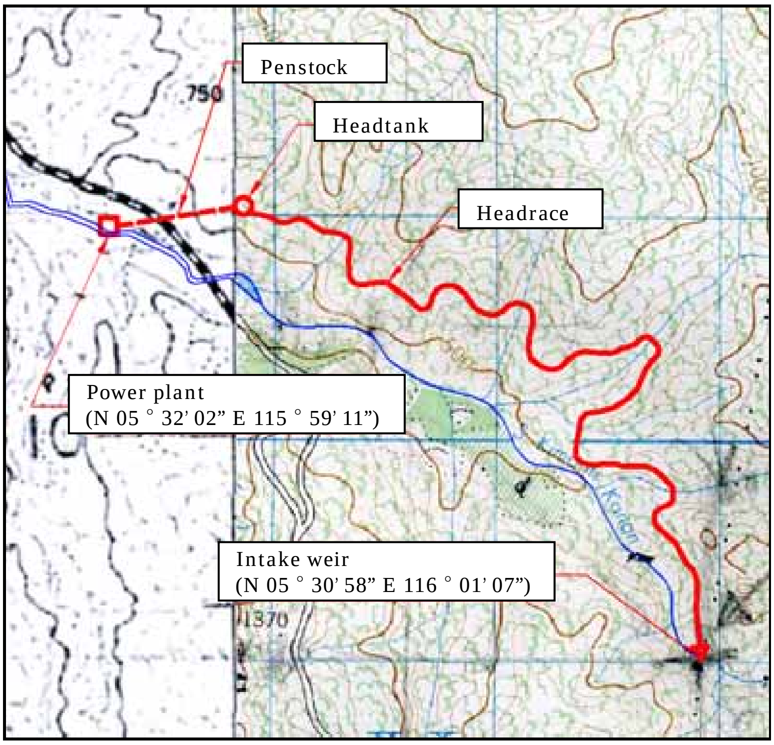

Figure-3 Channel route at Kimanis Kanan site

(2) Project boundary, Setting baseline and Demonstration of additionality

○ Methodology

Since the project is to construct and operate run-of-river type hydropower plant with 4MW of total maximum output at 2 sites (Kimanis Kanan site and Kimanis Kiri site), the small scale CDM methodology (hereinafter called AMS-I.D.) as mentioned below is applied.

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories.

"I.D. Grid connected renewable electricity generation"

○ Project Boundary

Based on AMS-I.D., because the project boundary is physically and geographically related to the small scale project activity, the project shall include the intake weir, penstock, power plant and tailracel since these facilities are linked Project (see the Figure-4). Moreover, the transmission line shall be extended to SESB's administrative boundary (connection point).

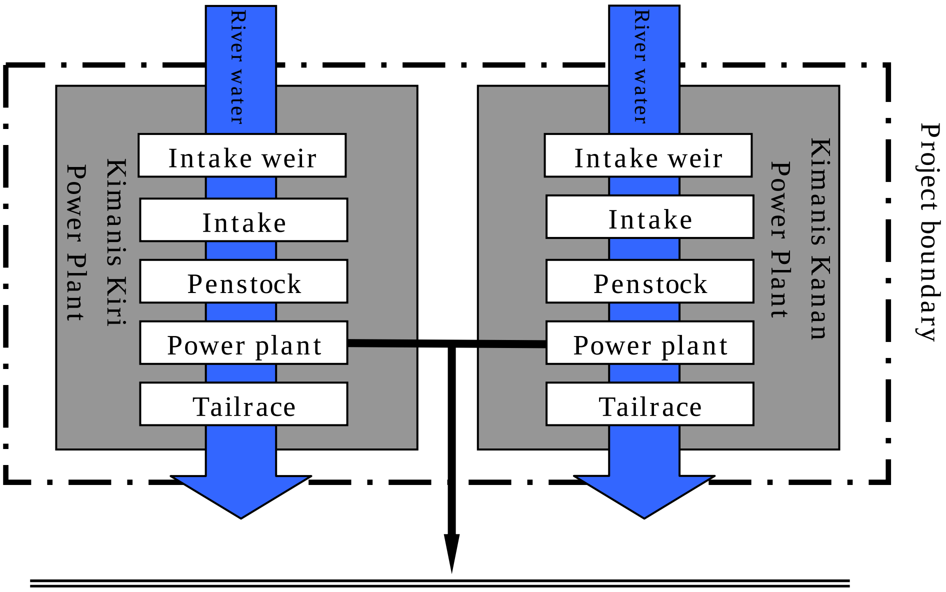

Figure-4 Project boundary

○ Setting baseline

Based on AMS-I.D., baseline is obtained by calculation of multiplying the emission coefficient (tCO_2/MWh) by the amount of electricity generated in the project. The emission coefficient is used by CM which value is obtained by weighted average of Simple OM and BM.

○ Demonstration of additionality

Since the project is a small scale CDM project, additionality shall be demonstrated based on the tool for the demonstration and assessment of additionality for small-scale CDM projects (Attachment A to Appendix B). Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the four barriers, i.e., investment barrier, technological barrier, Barrier due to prevailing practice and other barriers;

Out of the above barriers, the following investment barriers and barrier due to prevailing practice exist in the case of this project:

a) Investment barrier

Generally, the project scale of run-of-river type hydropower plant is small and generates low profit. Moreover, since business risk might be high due to occasional change of generating power during its long business term, it is not widely prevailing as general IPP project. On the contrary, IPP business utilizing thermal power is prevailing in each country with participation of investors because thermal power generates more than tens of MW and its business profit is much larger than hydro power.

In the State of Sabah, 5 IPP operate power plants are all thermal plant using diesel or natural gas as fuel. In recent years, construction of a gas combined cycle thermal power station is being planned. Therefore, it can be said that thermal power plant is the prevailing IPP projects in Sabah.

The result of local survey and hearing in Sabah shows that 10 – 12 % of IRR is needed to secure a loan from local banks to operate small scale hydropower generation in Malaysia. Since IRR value is calculated as 8.4 % (Power selling rate 0.19RM/kWh) without CER for 21 years of the term of project, thus it is difficult to secure a loan from local banks. However, if CER revenue is combined, it shall be 10.4 % (CER=10 EUR/tCO_2, power selling rate 0.19RM/kWh) and it shows that the project is sufficient undertaking to secure a loan from local banks.

Therefore, it is deemed natural that general IPP business operators should be interested in developing thermal power generation than this project.

b) Barrier due to prevailing practice

Actually in Sabah, there is only 6 run-of-river type hydropower plants which is being operated by SESB and no such plant is operated by any other private sector. Moreover, Small Renewable Energy Power Program (SREP) was formulated on May, 2005 which is aiming at promoting to develop renewable energy, it has not taken root even at the present time on October, 2006.

As a conclusion, run-of-river type hydropower plant is still not general and common in Sabah.

(3) Debundling

The proposal of the small-scale CDM projects that satisfy the following 4 criteria is considered as debundling;

- Participation of same project participants participate in the project.
- Same project category and same technology is applied
- Registration within the past two years
- The nearest project boundary lies within the proposed small scale project boundary no more than 1 km away

Since the project will be the first hydropower CDM project to be implemented in Malaysia by the project participants, it will not implement as a debundled undertaking of a large scale CDM project.

(4) GHG emissions reductions and leakage resulting from the project implementation

○ Project emissions

Based on AMS-I.D, the project will generate no GHG emissio, thus **PEy = 0**.

○ Baseline emissions

Based on AMS-I.D., baseline emissions are obtained by multiplying the CO_2 emission coefficient (tCO_2/MWh) by the amount of electricity generation (MWh) generated in the project. The result of calculation is shown below. Meanwhile, the CO_2 emission coefficient is calculated using CM obtained by Simple OM and BM. In addition, in Malaysia, PTM reports CM every year and we calculated CM of the project referring PTM's report.

Step 1: Calculation of Simple OM

① Confirmation of applied conditions of Simple OM

To use Simple OM, applied condition of Simple OM prescribed in the approved methodology ACM0002 must be satisfied. The applied conditions require that electricity generation from low-cost/ must-run resources must be less than 50 % of annual total electricity generation of the grid based on average value over the past 5years or based on long-term normals for hydroelectricity production. As shown in the Figure-5, energy of SESB by sources low-cost/must-run resources is less than 50 % of annual total electricity generation in the SESB grid, thus the project is applicable to Simple OM.

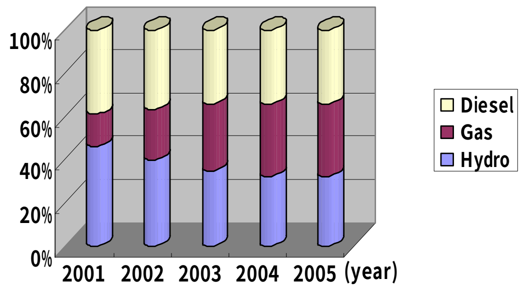

Figure-5 Annual total electric

② Calculation of Simple OM

Simple OM is the emission coefficient (tCO_2/MWh) obtained by calculation of weighted average from power source which is not low-cost/must-run resource (thermal power)

$$EF_{OM,Simple,y} = \frac{\sum_{i,j} F_{i,j,y} \bullet COEF_{i,j,y}}{\sum_{i} GEN_{j,y}} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots (2)$$

- $F_{i,j,y}$: the amount of fuel (i) (in a mass or volume) consumed by relevant power sources j in year(s) y.
- $GEN_{j,y}$: the electricity (MWh) delivered to the grid by source j.
- $COEF_{i,j,y}$: the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y.

$$COEF_i = NCV_i \bullet EF_{CO_2,i} \bullet OXID_i \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (3)$$

- NCV_i : the net calorific value (energy content) per mass or volume unit of a fuel i,
- $EF_{CO2,i}$: the CO_2 emission factor per unit of energy of the fuel i.
- $OXID_i$: the oxidation factor of the fuel.

The data used for calculating Simple OM is obtained by calculation ex-ante of the full generation-weighted average for the most recent 3 years.

Table-2 Calculation of Simple OM

Year	Electricity generation (MWh)	CO_2 emissions (tCO_2)
2002	1,358,813	554,321.13
2003	1,489,763	796,698.47
2004	1,516,198	1,074,465.32
Total	4,364,774	2,425,484.92

As the result of the examination, $EF_{OM,Simple,y}$ = 2,425,484.92 ÷ 4,364,774 = 0.550t CO_2/MWh was obtained from the Table-2.

Step2：Calculation of BM

Calculate the BM using the following formula;

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \bullet COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (4)$$

Where, F, COEF, GEN is the same parameter as prescribed in the formula (2) on power station ‘m’.

The data used for calculating the BM will be calculated ex-ante using the latest data. In addition, Power station ‘m’ that is targeted when calculating the BM is assumed as one of the following sample groups based on ACM0002:

(a) The five power plants that have been built most recently, or

(b) The power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and have been built most recently.

As the result of examination, total electricity generation in 2004 of the grid to which electric power generated by the project will be connected was 1,966,192 MWh, and among which the electricity generation of the five power plants that have been built most recently was 1,303,192.82MWh (See Table-3). Since the proportion of the electricity generation of the five power plants that have been built most recently have been exceeding 20% in the total electricity generation of the system generation, BM will be calculated using the data according to the method (a) above mentioned.

Table-3 Electricity generation and CO_2 emissions of the 5 power plants that have been built most recently (2004)

Power Plant Name	Date of the start of operation	Capacity（MW）	Electricity generation（MWh）	CO_2 emissions（tCO_2）
Powertron	1998	120	803,004.83	556,427
ARL	1996	50	53,369.82	37,733
Gantisan	1996	40	12,562,60	11,435
Patau-patau GT3	1995	33	423,627.55	354,700
Melawa	1995	20	10,628.40	9,675
Total	―	263	1,303,192.84	969,970

From above data, **$EF_{BM,y}$**は 969,970tCO2÷1,303,192.84MWh＝**0.744tCO2/MWh**

Step3：Calculation of CM

CM is calculated using the following formula:

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y} \quad \cdots\cdots (5)$$

Where, w_{OM} and w_{BM} are weight coefficients and the default value is 50% (w_{OM}=w_{BM}=0.5).
In the project, too, CM is calculated assuming the weight coefficients to be 50%.
Accordingly, **EF_y** is 0.550×0.5+0.744×0.5＝**0.647tCO2/MWh**.

Step4：Baseline emissions

In the project, the baseline is calculated using the following formulae based on AMS-I.D.

$$BE_y = EG_y \times EF_y \quad \cdots\cdots (6)$$

Where,

- BE_y : Annual baseline emissions (tCO_2)
- EG_y : Annual electricity generation obtained in line with the project (MWh/y). In this PPD, the total annual electricity generation of 24,000MWh/y generated by both power plants of Kimanis Kanan and Kimanis Kiri is used.
- EF_y : Grid emission coefficient in Sabah, Malaysia (tCO_2/MWh). In the project, CM obtained by Simple OM and BM is used. Thus, the result of calculation above mentioned of 0.647tCO2/MWh is used.

To sum up, annual baseline emissions in the project are **BE_y＝15,528 tCO2 15,500 tCO2**.

○ Leakage

Since the project does not entail utilizing power generating equipment from other projects, there is no leakage based on AMS-I.D.. (Ly = 0)

○ GHG emission reductions

The annual GHG reductions of the project can be obtained by the following formula.

$$ER_y = BE_y - PE_y - L_y \cdots\cdots\cdots\cdots (6)$$

・BE_y ：Annual baseline emissions（tCO_2）＝15,500tCO_2
・PE_y ：GHG emissions in line with the project activities（tCO_2）＝0
・L_y ：Leakage（tCO_2）＝0

As the result of calculation using above formula, the annual GHG reductions of the project is ER_y＝15,500tCO_2.

(4) Monitoring plan

AMS-I.D. will be applied in the project, and electricity generation will be measured based on that methodology. It is planned that electricity generation will be measured by kWh meter set in the connection point with the grid.

(5) Environmental impact / Other indirect impacts

○ Environmental impact

Generally in Malaysia, Environmental Impact Assessment (EIA) is not required to construction of a run-of-river type hydropower plant, however, the result of hearing on environmental regulations at Environmental Protection Department, Sabah, showed that unique environmental regulations are set in Sabah and the project was required to report the EIA.

The EIA shall be conducted by local environmental consultant appointed by the State government in which conditions of air, water quality, noise and other factors are evaluated in line with environmental regulations of the country. Since the project is a run-of-river type hydropower generation project which generates little impact to environment, and by our own evaluation based on the field surveys, we belive that the project will satisfy each regulation values.

○ Other indirect impacts

① Spillover effect to hydropower CDM undertaking
② Contribution to diversification of power sources in Sabah

(6) Stakeholder's comments

We visited government authorities listed below to collected comments on the project.

①MONRE（Ministry of Natural Resources and Environment）
②DOE（Department of Environment, Sabah）
③MEWC（Ministry of Energy, Water Resource and Communication）
④EC（Energy Commission）
⑤PTM（Energy Commission, Malaysia）
⑥MIDA（Malaysia Industrial Development Authority）
⑦SESB（Sabah Electricity Sdn.Bhd.）
⑧EPU（Economic Planning Unit, Sabah）
⑨DID（Department of Irrigation and Drainage, Sabah）
⑩EPD（Environment Protection Department, Sabah）
⑪Papar（Municipality）

They have made no specific comment on development as CDM project, rather, they made positive comments such as they 'welcome' or 'support' the project.

3. Towards commercialization

(1) Project implementation structure

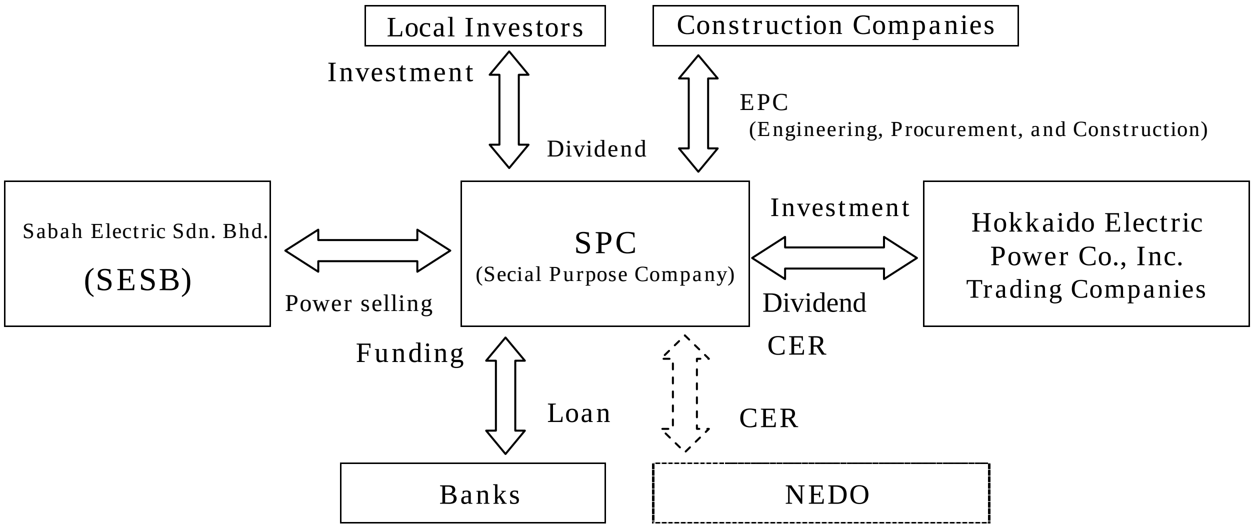

Figure-6 Project Implementation Structure Plan

(2) Financial plan

For the project, we plan to utilize SREP, the system targeting to renewable energy in Malaysia. We had discussions with authorities which hold jurisdiction over the system such as MEWC (Ministry of Energy, Water Resource and Communication) and EC (Energy Commission) on possibility of easing regulation of cap on maximum foreign fund fixed 30 %, however, their opinion was that easing was difficult because that regulation was set based on national policy.

Therefore, investment ratio of the project for Japanese side shall be 30 % and another 70 % is expected to be shared by local companies.

(3) Cost-benefit Performance

○ Investment ・Initial cost : 1.05 billion Yen ・Operation cost :330 million Yen

○ Economical study **(**Project IRR, Payout year**)**

Table-4 Project IRR、Payout year ※（ ）Payout year

CER price（EUR/tCO_2）	Unit price of power selling（RM/kWh）		
	0.17	0.18	0.19
No CER	6.6（14）	7.5（13）	8.4（12）
8	8.3（12）	9.2（12）	10.0（11）
10	8.8（12）	9.6（11）	10.4（10）
12	9.2（12）	10.0（11）	10.8（9）

The result of field survey and hearing in Sabah shows that 10 – 12 % of IRR is needed to secure a loan from local banks to operate a small scale hydropower generation in Malaysia. Since IRR value shall be 6.6 - 8.4 % without CER in the project, and it is recognized to be difficult to securing loan form local banks. On the other hand, in the cases that unit price of power selling is RM 0.18/kWh and CER price is EUR 12/ tCO_2, or, unit price of power selling is RM 0.19/kWh and CER price is more than EUR 8/ tCO_2, IRR would exceed 10 % and these cases might satisfy loan standard of local banks. These cases are, in addition, payout year would be less than 10 years approximately. Considering low country risk in Malaysia, it deemed to be good performances project. In other cases as well, it is possible to satisfy loan standard if construction cost could be reduced because IRR would be placed in the vicinity of 9 %.

Therefore, despite there still is factor of instability such as the result of discussion on the price of power selling and change of CER price, it is recognized that the project has potentiality to implement as CDM project even taking into account of Malaysia's country risk.

(4) Perspective and subject toward commercialization

As aforementioned, it is recognized that the project has potentiality of commercialization comparatively in the cases that unit price of power selling is RM 0.18/kWh and CER price is EUR 12/tCO_2, or, unit price of power selling is RM 0.19/kWh and CER price is more than EUR 8/tCO_2, Moreover, it could be a feasible project taking into account of country risk of Malaysia.

However, since the project still has some questions as stated below, we plan to go ahead toward implementation of the project handling these questions to improve accuracy of evaluation of the project.

① Surveying

We examined generation plan based on a topographical map with the scale of 1/50,000, however, this scale is not sufficient to make precise evaluation. It is necessary to conduct topographic survey to improve accuracy of generation plan.

② Price of power selling

The project is a hydropower generation undertaking and power selling should be a large income source. Since the price of power selling will be determined based on negotiation with SESB, it is necessary to have preliminary consultation with SESB after handling ① above mentioned to improve accuracy of generation plan.

③ Construction cost

The construction cost of the project was calculated based on the estimation of one local construction company. From this out, it is necessary to reevaluate construction cost upon obtaining estimates from several companies to improve reliability of the cost.