

2009 CDM/JI Feasibility Study: A Summary of the Report

Study name

Study of a small-scale hydropower CDM project in Lam Dong Province, Vietnam

Organization

Hokkaido Electric Power Co., Inc. (HEPCO)

Structure of study

- Dak Me Hydroelectric Joint Stock Company (HDM): Provide information on power generation and project plans.
- IE (Institute of Energy in Vietnam, under the umbrella of EVN): Assist PDD production.
- Local CDM consultant: Assist pre-validation on site.
- DNV (Designated Operational Entity): Perform pre-validation.

1. Project Overview

The project is the construction of a hydro power plant that is able to generate 4 MW in the Dak Me River in Lam Dong Province, Vietnam and the connection to the grid owned by Electricity of Vietnam (EVN) to sell the generated power. Since the electricity to be generated at the hydro power plant is clean energy with no greenhouse gas emissions, it also helps reduce the emissions as an alternative to the fossil fuels of the grid. The project is expected to have the effect of greenhouse gas emissions reduction of 11,000 tons of CO₂ every year. Dak Me Hydroelectric Joint Stock Company (HDM) is taking the initiative on the project and the construction work began on April 1, 2009.



Application methodology

AMS-I.D. Version 14

2. Contents of Study

(1) Tasks

- Validation of power generation plan:

The project plan is an important element to assess the volume of greenhouse gas emissions reduction. To this end, the validity of the plan that includes the capacity of the power plant needs to be examined.

- Collection of data necessary to demonstrate additionality:

Because there are many hydro power plants being constructed and operated in Vietnam, the additionality is demonstrated based on investment analysis. In order to perform investment analysis, IRR assessment and setting a benchmark are required based on the

Guidance on the Assessment of Investment Analysis (version 2), provided as attachment 45 at the 41st Board meeting. In the Guidelines, for example, when the project can be carried out by another business entity, the benchmark is required to be official data and can be clearly examined by the DOE. In the IRR assessment, the parameters need to be decided based on proper grounds. Thus, data needs to be collected to meet the guidelines.

- Collection of data necessary for obtaining the emission factor:
EVN manages the electric power grid in the country. Although the availability of official data is limited, it needs to be collected to obtain the emission factor.
- Formulation of monitoring plan:
The measuring and management methods of the electricity meter in the project need to be studied and a monitoring plan needs to be formulated.
- Collection of NOx, SOx, and other data (for co-benefit assessment):
Data on the emissions of such gases as NOx and SOx from thermal power plants connected to the electric power grid needs to be gathered for co-benefit assessment.
- Handling of pre-validation
A document required for the screening, in addition to PDD, needs to be prepared and collected for pre-validation.

(2) Contents of Study

○ Response to tasks

Task	Study result
Validation of power generation plan	Obtain inflow data and topographical maps when the power generation plan was formulated to verify the following: ①Power generating capacity, ②Dam stability, ③Volume of headrace passing water, ④Pressure of pipeline, etc.
Collection of data necessary to demonstrate additionality	The benchmark was set and IRR calculation was conducted based on the Guidance on the Assessment of Investment Analysis (version 2), provided as attachment 45 at the 41 st CDM Board meeting. Details are shown in (3-(10) and (11)).
Collection of data necessary for obtaining the emission factor	The Government of Vietnam (DNA) commissions the calculation of the emission factor to two domestic organizations (one of which is IE) in order to make the public data approved by the Government. As a temporary measure, the Government also has officially approved the emission factor obtained in the existing CDM project of Vietnam hydropower (Song Bung 4 Hydropower Project). Although we have obtained the data calculated by IE and in the Song Bung 4 Hydropower Project in this study, we may not be able to obtain approval for the data calculated by IE from the Government for the following reasons: ① Government approval requires time. ② The emission factor of the IE may not be used. Thus, we decided to use the officially approved emission factor used in the Song Bung 4 Hydropower Project and reflected it in PDD.

Formulation of monitoring plan	In Vietnam, each power company indicates the management method of the electricity meter for each project at the conclusion of PPA (power purchase agreement). Since the PPA is concluded before the operation begins, it is difficult to formulate a detailed monitoring plan at this point. Guidelines provided by EVN and/or MOIT (Ministry of Industry and Trade) were used as reference to formulate a plan and it is reflected in PDD.
Collection of NOx, SOx, and other data	The results of the hearing with EVN revealed that, although thermal power plants in Vietnam are subject to regulations on the emissions of such gases as SOx, NOx, and dust (TCVN7440:2005), they do not measure them, because they are not obliged to report it. Thus, it is difficult to make assessments based on the quantitative co-benefit assessment.
Handling of pre-validation	We prepared and collected documents required for the screening, in addition to PDD, and commissioned pre-validation to DNV (Det Norske Veritas). The following is the screening schedule: <ul style="list-style-type: none"> • Collection of public comments (Oct. 22 to Nov. 20, 2009) • Desk review • On-site review (Dec. 1 and 2, 2009) As the result of the screening above, there were some issues that were pointed out and PDD has been revised.

○ Other studied issues

Task	Study result
Confirmation of development progress	[As of Jan. 27, 2010] <ul style="list-style-type: none"> • Power plant: Ground leveling completed • Head tank and penstock: Under excavating • Access road: Ground leveling from dam and intake to headrace underway • Dam: Construction of foundation underway • Headrace: Ground leveling underway
Environmental impact assessment	Although Vietnamese laws and regulations do not require an EIA report for the project, Environmental Protection Commitment is needed. It was produced in July 2007 and the local government approved it. The contents of the commitment were confirmed and reflected in PDD.
Collection of comments of stakeholders	HDM gathered local stakeholders on August 2, 2008 to hold a stakeholder meeting. The contents of written evidence was confirmed and reflected in PDD.

3. Study Result for CDM Project Implementation

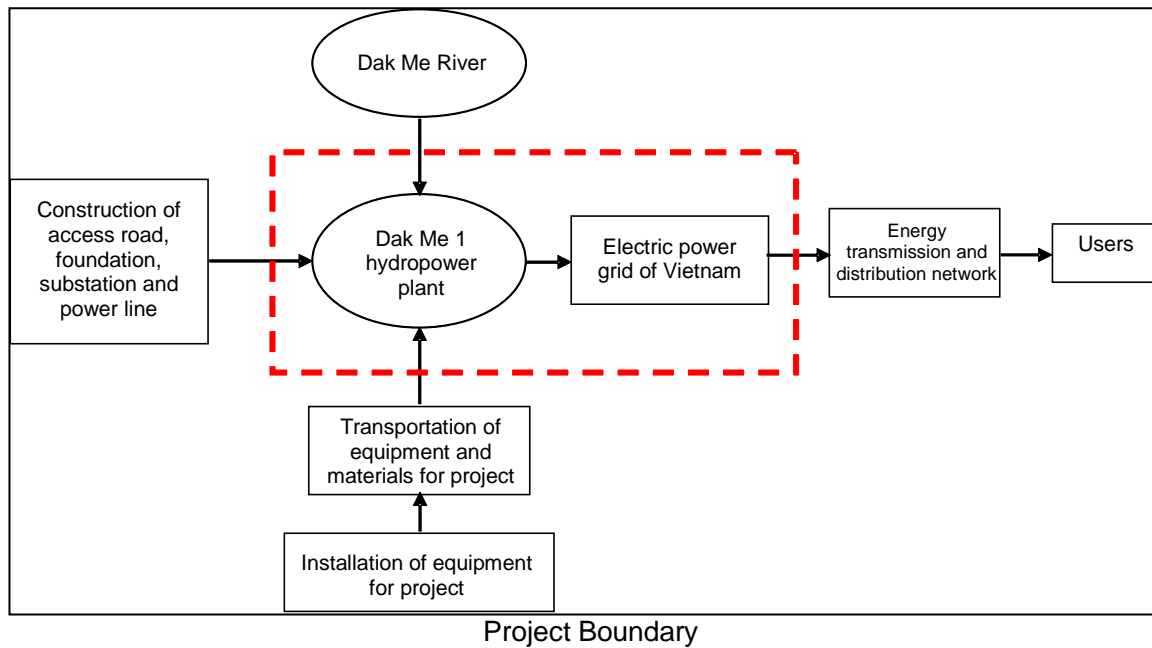
(1) Establishment of Baseline Scenario and Project Boundary

○ Application methodology

Since the project is a hydro power plant that is able to generate 4 MW to sell it to the electric power grid of Vietnam, approved small-scale methodology, AMS-I.D - Grid connection renewable electricity generation (version 14) is applied.

○ Establishment of baseline scenario and project boundary

The baseline scenario is to supply electric power generated in the project via the electric power grid in Vietnam. The power generation facility and the electric power grid in Vietnam are inside the project boundary.



○ Calculation method of baseline emissions

Baseline emissions are calculated in the following formula:

(Electricity (MWh) supplied to electric power grid) x (Grid emissions coefficient (tCO₂/MWh)

As the grid emissions coefficient, the combined margin (CM) obtained from the operating margin (OM) and build margin (BM) is used based on the tool to calculate the emission factor for an electricity grid (version 1.1). The OM is obtained from the Simple OM by ex-ante as well as BM. Data used to obtain the coefficients were provided by EVN. The following shows the calculation result:

OM	BM	CM
0.64293tCO ₂ /MWh	0.49279tCO ₂ /MWh	0.56786tCO ₂ /MWh

(2) Project Emissions

The project emissions are zero based on AMS-I.D. As for the leakage, the power generating unit used in the project is also zero because it is not the reutilization from another project.

(3) Monitoring Plan

The monitoring item of the project is power output supplied to the electric power grid. The output is calculated by the electricity meter to be installed in the substation that is a connecting point with the grid. A back-up electricity meter is also installed. The measured values are crosschecked with the receipt for selling electricity to EVN. The power output is measured continuously and the record is stored monthly in writing and in electronic data. All records are stored for at least two years after the completion of the first credit period.

(4) Greenhouse Gas Emissions Reduction Volume (or Sinks)

(Unit: tCO₂)

Year	2011	2012	2013	2014	2015	2016	2017	Total of 1 st credit period
Project emissions	0	0	0	0	0	0	0	0
Baseline emissions * Alternative fossil fuel of electric power grid	10,676	10,676	10,676	10,676	10,676	10,676	10,676	74,732
Leakage	0	0	0	0	0	0	0	0
Total	10,676	10,676	10,676	10,676	10,676	10,676	10,676	74,732

(5) Project Period and Crediting Period

○ Project period and crediting period

The guidelines of MOIT stipulate that the project period of a hydropower station with an output capacity of 30 MW or less is 20 to 40 years. We decided to use 30 years, which is in between 20 years and 40 years, as the project period. The crediting period is for 21 years based on the calculation of seven years multiplied by 3 times (2 renewals).

○ Date of project commencement

The project began on April 1, 2009, the date of the conclusion of the agreement on construction work of such major structures as the power plant and dam. Since the date is after August 2, 2008, we gave notice to the CDM Board (on September 24, 2009) and the Government of Vietnam (on September 26, 2009) in the specified form based on the Guideline on the Demonstration and Assessment of Prior Consideration of the CDM. The notice to the CDM Board is posted on its website. As written evidence of prior CDM, the following two issues were also confirmed:

- ① Documents of the board meeting that shows that the project investor gives consideration to CDM before the beginning of the construction
- ② Memorandum that shows that CDM procedures will begin together with CDM consultants before the beginning of construction

(6) Environmental Impact and Other Indirect Impacts

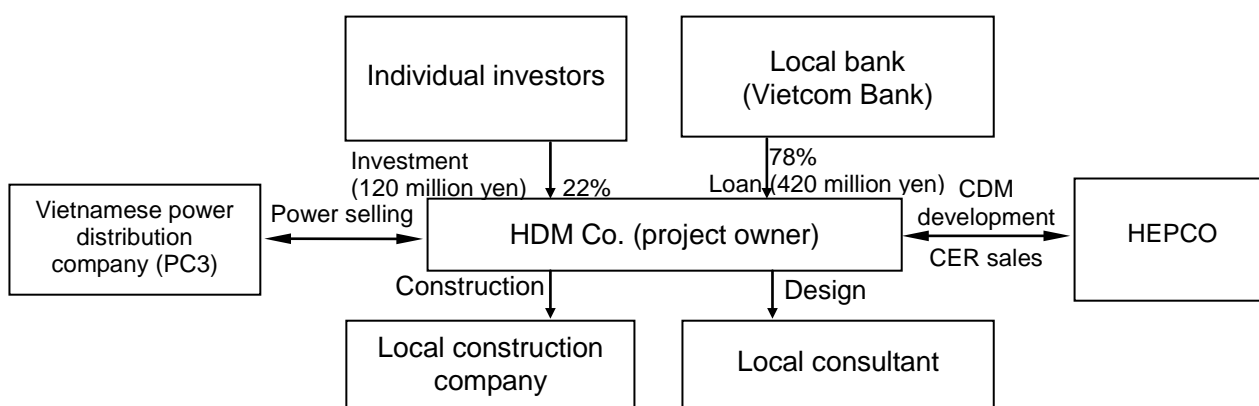
Vietnamese guidelines require hydropower plants with a reservoir capacity of 1,000,000 m³ or more to perform an EIA. Since the reservoir capacity of the project is 127,000 m³, an EIA does not have to be performed, although an Environmental Protection Commitment is required to be produced. The commitment was produced in July 2007 and approval from relevant entities and local people was obtained.

There is no other negative indirect impact.

(7) Stakeholder's Comments

A stakeholder meeting was held on August 2, 2008, in Dam Rong commune, Dam Long district, Lam Dong Province, based on the guidelines for CDM projects and power generation investment development in Vietnam. The meeting was attended by a representative of the people committee of the Da Long commune, representatives of major relevant organizations in the commune, and local people. The project owner (HDM) explained about an overview of the project. All participants expressed their thoughts that the project would have a positive impact on the sustainable socioeconomic development in the remote mountainous area made up of ethnic minorities. They commented that they would support the project. We also received a written statement dated on June 5, 2009, from the people committee of Lam Dong Province that they would support the project as a CDM project. We have obtained comments from all stakeholders that they would support the project as a CDM project.

(8) Project Implementation Structure



(9) Funding Plan

The project is planned to be funded by individual investors (120 million yen) and bank loans (420 million yen) by Vietcom Bank. The project owner concluded a loan agreement with the local bank on August 29, 2009.

(10) Economic Analysis

When the benchmark, 13.125%, in the following page is used as the investment decision criterion, PIRR without CDM is 10.23%, which shows that the project is not financially attractive. On the other hand, if the CER price is 12EUR/tCO₂, PIRR increases to 13.40%, exceeding the benchmark. The payout time is nine years without CDM and seven years with CDM, in which case the length is same as that of the first credit period and credit renewal risks can be taken into consideration and thus the project is economically efficient to some degree.

Economic Analysis Result

Item	Without CDM	With CDM
PIRR	10.23%	13.40%
Payout time	9 years	7 years

* With CDM: CER price is 12EUR/tCO₂

(11) Demonstration of Additionality

Since it is a small-scale CDM project, additionality is demonstrated with the Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities. According to the guidelines, at least one of the barriers in the table below needs to be demonstrated when a project participant demonstrates the additionality of a small CDM project.

Investment barrier	A financially more viable alternative to the project activity would have led to higher emissions.
Technological barrier	A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.
Barrier due to prevailing practice	Prevailing practice or existing regulatory or policy requirements would have led to the implementation of a technology with higher emissions.
Other barriers	Without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The major barrier of the project is the financial barrier categorized in other barriers. It is demonstrated with the benchmark analysis. According to Item 12 in the Guidance on the Assessment of Investment Analysis (version 2), provided as attachment 45 at the 41st Board meeting (Annex 45 of EB 41), when the project can be carried out by other entities than the project participants, the benchmark is required to be obtained from an officially available information source and clearly verifiable by the DOE.

For the project, 13.2%, which is the interest rate of the local commercial bank of Vietcom Bank as of May 16, 2008, was used as the benchmark to determine the execution of the project. However, the benchmark does not fulfill the requirement described above.

Meanwhile, Article 467 of the Civil Code of Vietnam stipulates that the commercial lending rate limit is 150% of the basic rate provided by the State Bank of Vietnam and it fulfills the requirement. The prime lending rate issued by the State Bank of Vietnam was 8.75% according to the Decision No. 978/QD-NHNN, official document issued on May 1, 2008. When the upper limit under the Civil Code is taken into consideration, the maximum commercial lending rate is 13.125% (150% \times 8.75%). The obtained figure is rather conservative compared with the 13.2% interest rate of commercial banks, with a very small gap between the two. Thus, it does not affect the decision-making on investment by project investors.

According to an IMF report issued in December 2007, the interest rate in the Vietnamese financial market was 13.7% as of May 2007, while then commercial lending rate limit was 12.375%. This shows that many commercial banks provided loans with the interest rate that exceeds the upper limit. Thus, the commercial lending rate limit can be understood as a conservative benchmark for IRR analysis.

Thus, we concluded that 13.125% is the most suitable benchmark and decided to use it for

the benchmark analysis.

IRR of the project is 10.23% with no CDM revenue, which is lower than the benchmark of 13.125%. Thus, there is an investment barrier in the project if there is no CDM revenue.

○ Sensitivity analysis

Sensitivity analysis of values necessary to obtain IRR that exceeds the benchmark is performed for each main parameter listed below as DNV's original requirement to demonstrate that the figures cannot be real.

- Annual net power generation
- Investment cost
- O&M cost
- Electricity tariff

The table below shows the sensitivity analysis result. Values of each parameter necessary to reach the benchmark of 13.125% are also shown in the table.

Sensitivity Analysis Result

Parameter	Value of parameter variable necessary to reach the 13.125% benchmark	Base value of each parameter	Rate of parameter variables
① Net power generation (MWh)	22,976	18,800	22.21%
② Investment cost (VND in billion)	79.202	96.800	-18.18%
③ O&M cost (%)	-1.39	1.00	-239.00%
④ Electricity tariff (VND)	846.92	693	22.21%

① Annual power generation

Annual power generation was obtained based on the hydrological data for the last 27 years, included in the FS report. The assumed rise of 22.21% is unrealistic. Thus, IRR does not reach the benchmark of 13.125%.

② Investment cost

Agreements on major construction and other work for the project were concluded between April 2009 and preparation of the preliminary report. The total cost in the agreements is approximately 84 billion VND, which accounts for 87% of total investment cost. In addition, the cost to install power lines to the national grid from the project site is about 12 billion VND. When these costs are combined, it is 96 billion VND, which accounts for 99% of the total cost. Thus, the assumed decrease of 18.18% of the investment cost is unrealistic and IRR cannot reach the benchmark of 13.125%.

③ O&M cost

Under the assumption that the O&M cost drops to negative 239% or the negative 0.75% of the total investment cost is the maintenance cost, IRR reaches the benchmark of 13.125%.

However, O&M cost cannot be below zero and thus IRR cannot reach the benchmark of 13.125%.

④ Electricity tariff

IRR reaches the benchmark under the assumption that the unit price of power selling rises by 22.21% to 846.92 VND/kWh (5.13 US cent/kWh). The tariff used in the project, 693 VND/kWh (4.2 US cent/kWh), is based on the FS report and the actual price is determined by PPA to be concluded when the operation of the project begins.

The tariff in PPA and MOU concluded between other independent power producers (IPP) and EVN recently was determined in the range of 594 to 610 VND/kWh (3.68 to 3.84 US cent/kWh), and the tariff cannot reach 846.92 VND/kWh (5.13 US cent/kWh). Thus IRR cannot reach the benchmark of 13.125%.

Based on the result described above, when the parameters in the sensitivity analysis are set within a realistic range, IRR is lower than the benchmark. Thus, the project is not financially attractive. This demonstrates that it is difficult to carry out the project without CDM revenue.

(12) Perspective of Commercialization

Since the project owner and a local bank have concluded a loan agreement and the construction has begun, it is highly likely to be completed for commercialization.

4. Pre-validation

(1) Overview of (Pre-) validation

We commissioned the pre-validation of the project to DNV. The major screening results are shown below. Through the screening process, PDD and relevant documents were reviewed.

- Collection of public comments (Oct. 22 to Nov. 20, 2009)
- Desk review
- On-site review (Dec. 1 and 2, 2009)

(2) Communication with DOE

The result of the screening was generally good, although there were some issues that were pointed out. The issues and responses to them are shown in the table below. Because some of them need discussions and coordination with HDM, a meeting is planned in Vietnam in late January 2010 and thus are indicated as “under review” in the report. These issues under review are mainly related to the monitoring plan and do not affect the procedures up to the CDM Board registration.

Issued Pointed Out by DNV and Revisions and Responses

No.	Issues	Contents	Response
1	Government approval	Approval from the Government of Vietnam and Japan needs to be obtained.	Government approval is planned to be obtained.
2	Additionality	Although sensitivity analysis ($\pm 10\%$) of such major items as electricity tariff and investment cost is performed, values necessary to obtain IRR that exceed the benchmark for each major item need to be analyzed as DNV's original requirement to explain that the values are not realistic at all. (E.g.) IRR of the project exceeds the benchmark when the investment cost is negative 15%. The reason why the investment cost cannot be negative 15% needs to be explained.	Described in PDD. (See 3. (11).)
		Since the CDM activity table lacks the description of such major activities as issuance of FS reports and conclusion of major device agreements, they need to be added.	Added to PDD.
		Additionality needs to be demonstrated when the investment decision is made.	PDD was reviewed. (See 3. (11).)
		Written evidence needs to be produced to demonstrate the following barriers: <ul style="list-style-type: none"> • Uncertainty of power output due to the changes in river environment (mainly in the dry season) • Uncertainty due to unsettled electricity tariff • Loss due to flooding in the rainy season 	Since these barriers are common issues, there is no specific evidence document. Therefore, we deleted the description in PDD.
3	Monitoring plan	Although it is said that the measurement with the electricity meter is performed on every hour, continuous measurement is required in the methodology. Thus, it needs to be reexamined.	PDD was reviewed.
		Operation training and management methods need to be described.	Described in PDD.
		Specifications of the electricity meter need to be described.	Specifications of the electricity meter are planned to be obtained.
		Procedures and the structure plan on the measurement and report need to be described.	Procedures and the structure plan are planned to be prepared.
4	Others	It needs to be described that the power plant does not use fossil fuel (diesel power generation) for the source of backup and start-up power.	Described in PDD.
		It needs to be described that the project development includes conversion of farming land.	Described in PDD.
		How notices were given to stakeholders when their comments were gathered needs to be clearly described.	Described in PDD.

5. Survey Result Related to Co-benefit

(1) Assessment of such Effects as Environmental Pollution Measures in Host Country

The project is a hydropower project. The assessment method for reduction of such emissions as SO_x, NO_x, and dust by the grid thermal power generation is described in the co-benefit quantitative assessment manual. However, the results of the hearing with the EVN revealed that, although thermal power plants in Vietnam are subject to regulations on the emissions of such gases as SO_x, NO_x, and dust (TCVN7440:2005), they do not measure them, because they are not obliged to report it. Thus, it is difficult to make assessment based on the quantitative co-benefit assessment.

6. Survey Results Related to Contribution to Sustainable Development

- The project implementation creates employment.
- Construction of the access road improves access to neighboring farmland.