CLEAN DEVELOPMENT MECHANISM

PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 – in effect as of: 22/12/2006

CONTENTS

ANNEXES

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Document>.
03	22 December 2006	• The Board agreed to revise the CDM Project Design Document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

Title: Dak Me 1 Hydropower Project in Vietnam

Version: 03

Date: 08/03/2010

A.2. Description of the small-scale project activity:

Dak Me 1 Hydropower Project is located in Da Long commune, Dam Rong district, Lam Dong province in the southeast area of Vietnam. It uses water from Dak Me stream for generating electricity. Dak Me stream joints to the Krong Kno River at the left bank of the River which is belonged to the Serepok river system. The project owner is Dak Me Hydroelectric Joint Stock Company.

The main purpose of the project is to generate clean form of electricity using the potential energy available in the water flows of Dak Me stream in order to sell electricity to national grid via a Power Purchase Agreement (PPA) that will be signed with Vietnamese distribution company (Power Company: PC3) .

The total installed capacity of the project is 4 MW, with an estimated annual gross energy generation is 18.99 GWh. The net electricity generated with an estimated annual amount of 18.80 GWh will be supplied to national grid via a newly constructed 35 kV transmission line with length of 20 km from the project site to connected point of the existing national grid.

The project activity will generate renewable electricity with negligible GHG emission, which will displace part of the electricity otherwise supplied by the existing national grid that includes fossil fuel fired power plants.

Implementation of the project involves the construction of a small reservoir with its surface area is 2.1ha. The power density of the project is 190.48 W/m^2.

Thus, GHG emission reduction can be achieved via this proposed project activity. Total annual expected CO_2 emission reduction is 10,676tCO_2 by the project. The amount of emission reductions estimated for the first crediting period (7 years) is 74,732 tons CO_2.

Contribution of the project in sustainable development

The proposed project will contribute to sustainable development with the following aspects.

Contribution towards national sustainable development

- In recent years, Vietnam evidenced high growth rate of electricity consumption demand (more than 13%/year[1]). The high growth rate of electricity consumption that results in electricity shortage to supply for many areas/provinces. This hydropower project will contribute in reduction of shortage of electricity supply and imbalance between electricity demand and supply.
- In Vietnam, more than 50% of total electricity is generated from fossil fuel fired power plants (coal, diesel oil, and gas), the proposed project activity will replace part of electricity otherwise supplied by fossil fuel fired power plants, therefore, emissions of CO_2, SO_x and NO_x will be reduced, which mitigate the air pollution. The project activity will encourage development of renewable energy in Vietnam and reduce burden on dependence on fossil fuel resources.

[1] EVN Masterplan for Electricity Production 6

Contribution towards local sustainable development

- The project activity would contribute to the creation of employment opportunities to the local people during the construction of the project and provides regular employment opportunities during project operation.

- This project is located in remote rural areas, so that the project activity will contribute directly to improve the low – quality infrastructure systems of the Da Long commune. Construction activities in such remote areas often require development of local roads that improve access of remote rural communities.

- By supplying a stable electricity output, this project activity will facilitate the industrialization process of the province and leverage the performance of traditional trade villages as well as tourism and services inside the province.

- The project will construct a new 20 km transmission line at the level of 35 kV together with Dak Me 1 hydropower plant to export electricity to the national grid. The commission of Dak Me 1 hydropower plant will contribute indirectly to reducing electricity losses and improving the electricity quality supplied in the district and province.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participants (*) (as applicable)	Kindly indicates if the Party involved wishes to be considered as project participant (Yes/No)
Socialist Republic of Vietnam	Private Entity: Dak Me Hydroelectirc Joint Stock Company	No
Japan	Private Entity:Hokkaido Electric Power Co., Inc.	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Socialist Republic of Vietnam

A.4.1.2. Region/State/Province etc:

Lam Dong province

A.4.1.3. City/Town/Community etc:

Dam Rong district/ Da Long commune

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies) (maximum one page):

Dak Me 1 hydropower project is located in Da Long commune, Dam Rong district, Lam Dong province, in the northwest distance of about 120km from Da Lat city. It uses water from Dak Me stream which is a branch of the Krong Kno River located in the north of Lam Dong province.

The geographic coordination of the project: Northern latitude: 12°8'15" and Eastern longitudes: 108°19'20".

The site of the project is showed in Figure A.1.

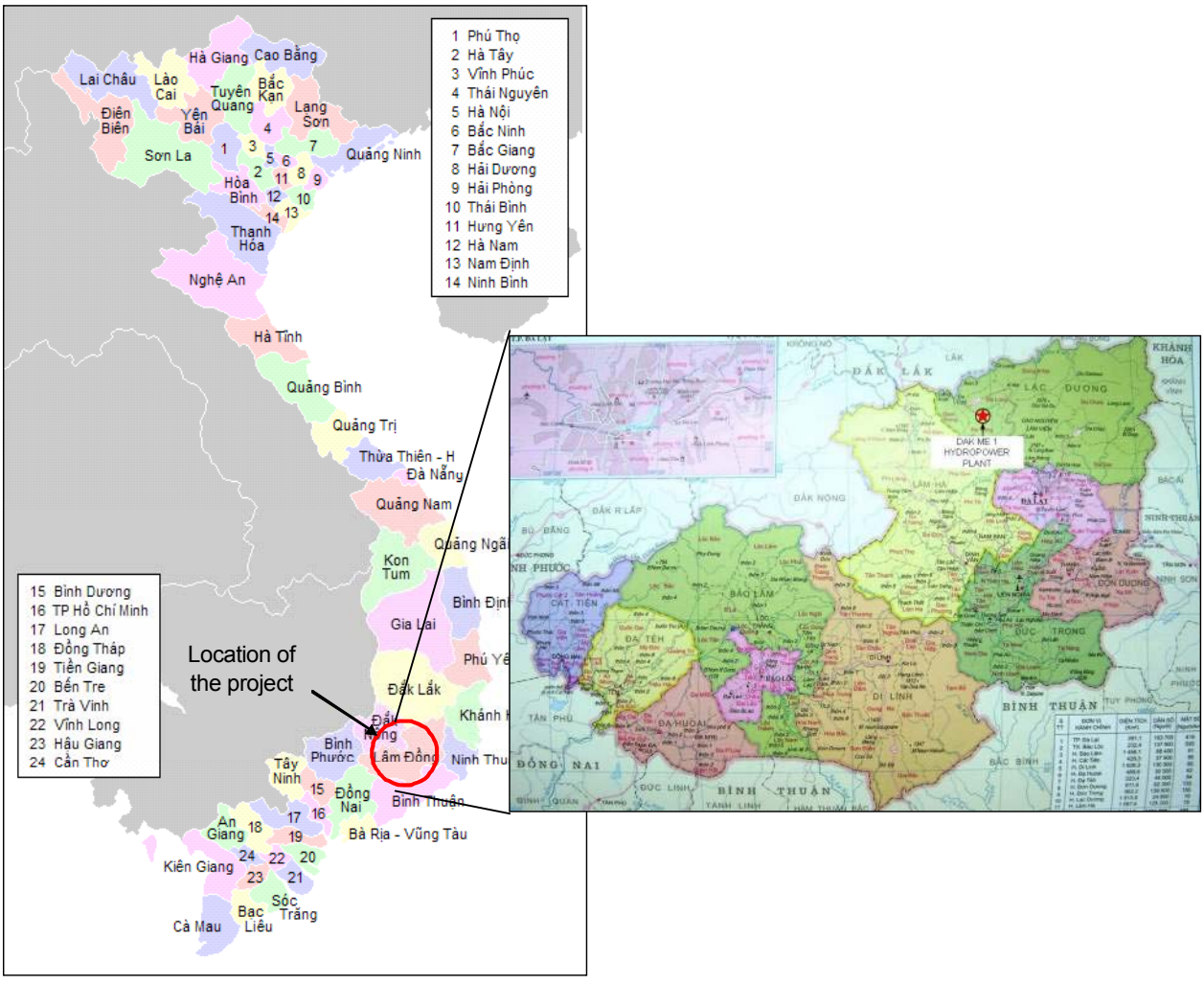

Figure A.1. Project site on the map

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

According to the classification in the Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the categories of projects are defined as follows:

- Project Type: I - Renewable energy projects
- Category: I.D - Grid connection renewable electricity generation

Technology to be employed by the project activity:

The total installed capacity of the project is 4MW, consisting of two 2MW units, with an estimated annual gross energy generation is 18.99 GWh. The net electricity generated with an estimated annual volume of 18.80 GWh will be supplied to the national grid via a newly constructed 35 kV transmission line with length of 20 km from the project site to the existing national grid. Figure A.2. shows the layout of the project.

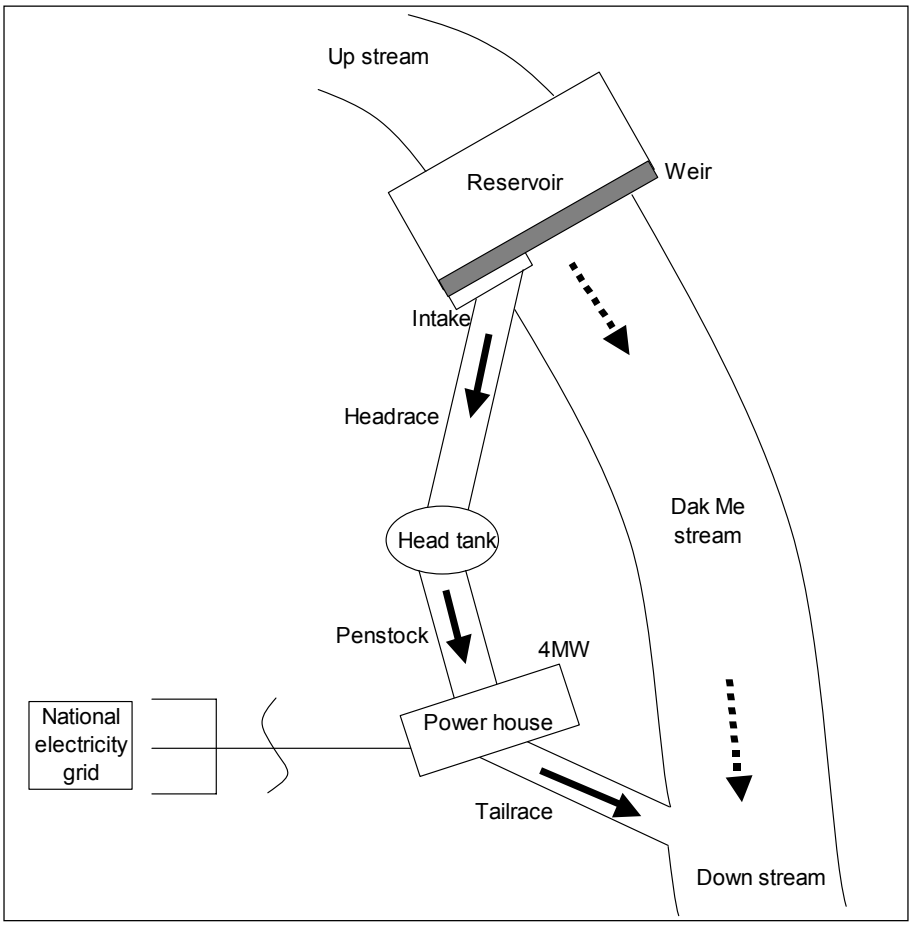

Figure A.2. Project layout

Main mechanical and electrical equipments are given in Table A.1.

Table A.1. Technical data of main equipment of the Dak Me 1 hydropower plant[2]

Parameters	Technical specifications
Turbine	**CJA237-Wj-100/1x12**
Runner diameter (m)	1.0
Rated output (kW)	2612
Rated flow (m3/s)	0.86
Rated rev (r/min)	750

[2] The information are taken from Equipment contract

Generator	**SFW2500-8/1730**
Rated capability (kVA/kW)	3125/2500
Rated voltage (kV)	6.3
Rated current (A)	286.4
Power factor (cosφ)	0.8
Rated frequency (Hz)	50
Rated rev (r/min)	750
Governor	**YWCT-25/15-4.0**
Inlet valve	**Z941H-6mpa/φ400**

A.4.3. Estimated amount of emission reductions over the chosen crediting period:

The expected emission reduction is calculated based on the net electricity selling and CO_2 emission factor of the national grid.

The project will apply for seven-year crediting periods (3x7 years). The estimated emission reductions of the first crediting period (from 01/01/2011 to 31/12/2017) are presented in the following table. The amount of emission reduction estimated for the first crediting period (7 years) is 74,732 tons CO_2.

Table A.2. Emission reduction of the proposed project during the first crediting period

Years	**Annual estimation of emission reduction in tons CO_2**
2011	10,676
2012	10,676
2013	10,676
2014	10,676
2015	10,676
2016	10,676
2017	10,676
Total estimated reduction (tons CO_2)	**74,732**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reduction (tons CO_2)	**10,676**

A.4.4. Public funding of the project activity:

No any public fund from Annex 1 countries is involved in this project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

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

- With the same project participants;
- In the same project category and technology / measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1km of the project boundary of the proposed small-scale activity at the closest point.

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

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Project Type:	Type I - Renewable energy projects
Category:	AMS-I.D - Grid connection renewable electricity generation
Version:	14, EB 48
Reference:	Appendix B of the simplified modalities and procedures for small scale CDM project activities

B.2. Justification of the choice of the project category:

The project uses available water for electricity generation, which falls under the category of renewable energy. The project involved installation of a hydropower plant with capacity of 4MW, not exceeding the threshold capacity of 15MW, the project activity can be regarded as a small-scale CDM project activity.

The electricity generated will be supplied to the national grid. According to small-scale CDM modalities, the project activity falls under Type I - renewable energy projects, and category AMS-I.D - grid connected renewable electricity generation.

Therefore, AMS-I.D has been applied for the project.

B.3. Description of the project boundary:

According to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the boundary for this project type encompasses:

- Geographical site: the area where the project is constructed.
- Physical boundary: the national power grid to which the project is connected.

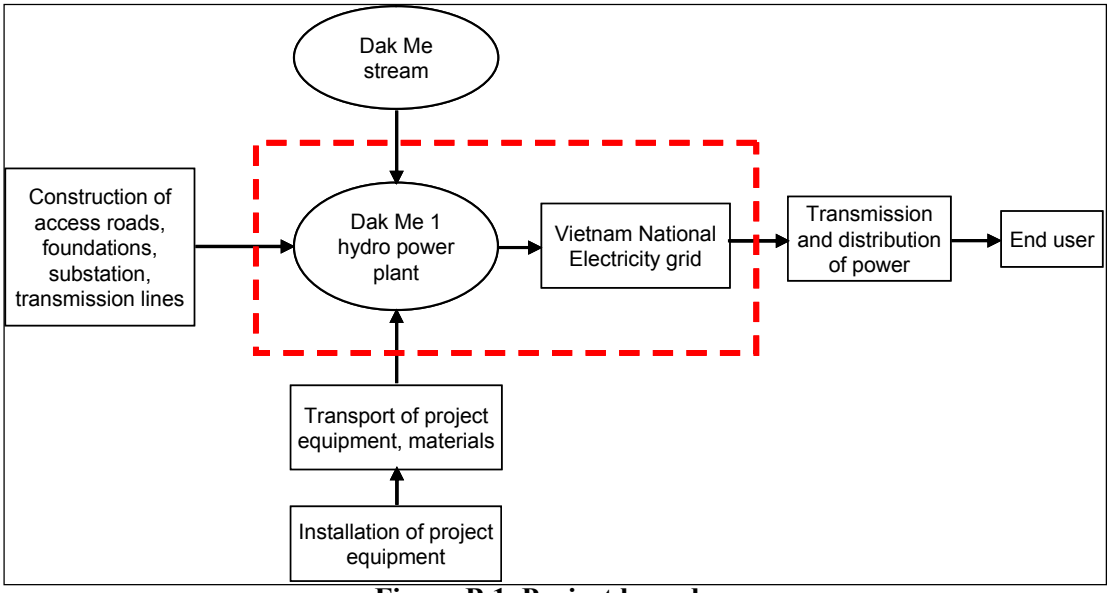

Figure B.1. Project boundary

The project will generate electricity by water source and be connected to the national grid. Hence for the purpose of baseline calculations, National grid of Vietnam is identified as the project boundary for this specific project activity.

B.4. Description of baseline and its development:

The following are realistic and credible alternatives to provide the same amount of power as the project activity:

Alternative 1: The project activity will be implemented without the incentive from CDM

As will be demonstrated in the following sections, the alternative 1 cannot be the baseline scenario because it is not a financially attractive option.

Alternative 2: The generation of equivalent amount of electricity will be provided by existing plants that are connecting to the national electricity grid

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin calculations described in the "Tool to calculate the emission factor for an electricity system".

The proposed project activity involves the installation of new hydropower plant that connect to and deliver electricity to the national electricity grid of Vietnam.

Thus the baseline of the proposed project is the delivery of equivalent amount of annual electricity from the national grid to which the proposed project is connected.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities, the project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

b) 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;

c) 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;

d) 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 main barrier identified by the project owner at the date of decision making was the financial barrier of Other barriers and the project owner hence made the decision to implement the project as a CDM project activity. The existence of the barrier is demonstrated in the following by benchmark analysis.

Other Barriers: Financial barrier

As the project generates financial benefits other than CDM related income, investment comparison

analysis or benchmark analysis needs to be used to demonstrate additionality. As there are no other realistic and credible baseline scenario alternatives other than electricity supply from the grid, benchmark analysis is chosen to prove the additionality. In the following, the financial internal return rate of the project (project IRR) was compared to the benchmark. This benchmark represents the minimal required IRR of the project to be financially attractive.

Identification of an appropriate benchmark

The Additionality Tool stipulates that the benchmark/discount rates shall be derived from inter alia "Government/official approved benchmark where such benchmarks are used for investment decisions and the local commercial lending rate or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR". Besides, EB 41 Report, Annex 45, section 11 also requires, "In the cases of projects which could be developed by an entity other than the project participant, the benchmark should be based on publicly available data sources which can be clearly validated by the DOE". Hence, the selected benchmark should satisfy two conditions: it should be Government/official approved (1); and it should be publicly available data source so that DOE can validate (2).

In the investment decision, the PO's Board made a decision to implement the project by using of a investment benchmark of 13.2% based on a confirmation from a private bank on dated 16 May 2008.

However, considering above two requirement , it can be seen that this figure is not an appropriate benchmark because it is not approved by the government and not a public available data also.

Keeping the above conditions in view together with common practice in Vietnam, it seems that there is only one figure that can be considered as an appropriate benchmark is that the commercial lending rate is defined based on combination of 1) prime lending rate that has been defined by the State Bank of Vietnam and 2) the Vietnam Civil Law 2005.

The Vietnam Civil Law, article 467 stipulated that "The commercial lending rate shall be 150% of prime lending rate that is defined by the State Bank of Vietnam".

At the time also of issue of the confirmation of 13.2% interest rate from private bank, the State Bank of Vietnam has issued a prime lending rate of 8.75% via the Decision No. 978/QĐ-NHNN dated April 29th, 2008. According to the Vietnam Civil Law mentioned above, the commercial lending rate should be 150% x 8.75% = 13.125%.

This figure therefore should be selected to be an appropriate benchmark because it meets not only the two above requirement but also conservative in comparing with the figure of 13.2%. Moreover, the difference between these two values is so small so the figure of 13.125% will not be impact on the PO's investment decision.

According to the IMF report, December 2007, the interest rate of Vietnamese financing market is of 13.7%[3] on May 2007, when the commercial lending rate was 12.375%[4]. These is because, many commercial banks in practice exceeded the state's limit on interest rate and offered loans at a rate above the commercial lending rate. This explains that the commercial lending rate of 13.125% can be consider as a conservative benchmark value for the demonstration of financial barrier.

Therefore, it can be concluded that the figure of 13.125% hence should be the most appropriate benchmark.

The project developer has compared the return obtained from the project activity with this benchmark to prove the project is financially unattractive. The parameters used to calculate the return from the project activity are shown in Table B.1.

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[3] http://www.imf.org/external/pubs/ft/scr/2007/cr07386.pdf, p24

[4] http://www.sbv.gov.vn/en/CdeCSTT-TD/laisuat2.jsp

Table B.1. The main financial parameters of the project

No.	Parameter	Unit	Value
1	Installed capacity	MW	4
2	Annual net electricity generation	MWh	18,800
3	Total investment cost	billion VND	96.8
4	Tariff of electricity sold to the power grid	VND/kWh	693
5	Total annual O&M cost	billion VND	0.968
6	Construction period	Year	2
7	Lifetime of the project	Year	30
8	Depreciation period	Year	20
9	Natural resources tax	%	2
10	Enterprise revenue tax	%	
	- For the first 4 years		0
	- For the next 10 years		5
	- For the next 1 year		10
	- For the remaining years		28
11	**IRR (without CDM)**	**%**	**10.23**

This table shows that the IRR of the project without CDM (10.23%) is lower than the benchmark of 13.125%. Therefore, if without CDM, the project shall face financial barriers.

Table B.2. Comparison of IRR with the benchmark rate of return

	IRR	Benchmark
Value	10.23%	13.125%

However, IRR will be much increased if the project has revenues from CO_2 emission reduction, event increased to 13.40% (if price of emission reduction reaches 12[5]EUR/tCO_2), higher than benchmark of 13.125%, which leads to decision on investment of the project. It is clear that revenues from CDM will help the proposed project remove the financial barrier which impacts on the project activity.

Sensitivity analysis

A sensitivity analysis has been conducted using assumptions that are conservative from the point of view of analysing additionality, i.e. the 'best-case' conditions for the IRR were assumed by altering the following parameters:

- Annual electricity generation
- Investment costs
- O&M costs
- Electricity tariff

Table B.3. summarizes the results of the sensitivity analysis, showing the variation of each parameter needed to reach the 13.125% benchmark.

[5] The price level was also mentioned in the investment decision of the PO's Board

Table B.3. Results of sensitivity analysis

Parameters	Variation of the parameters needed to reach the benchmark of 13.125%	Basic value of each parameters	Variation of parameters in percent
Net electricity generation (MWh)	22,976	18,800	22.21%
Investment cost (VND in billion)	79.202	96.800	-18.18%
O&M cost (%)	-1.39	1.00	-239%
Power tariff (VND)	846.92	693	22.21%

+ Annual electricity generation

The expected annual electricity generation of the proposed project indicated in the FS Report was calculated based on 27 years historical hydrological data. As the annual electricity generation was calculated based on historical data, assuming increase of 22.21% in annual electricity generation therefore is unrealistic, and that the IRR is not likely to reach the 13.125% benchmark.

+ Investment costs

Construction of the main works of the project has been carried out from April 2009, and until now, total cost of signed contracts is around 84 billion VND, it accounts for 87% of total investment cost. And moreover, cost of transmission line construction from the project site to the national grid is estimated to be about 12 billion VND, not included yet in the figure of 84 billion VND, which leads to the sum of 96 billion VND or 99% of total investment. Therefore, 18.18% decrease in investment costs is not realistic and the IRR cannot reach the 13.125% benchmark.

+ O&M cost

The IRR will reach the benchmark when the O&M cost is decreased by –239% which is –1.39% of Investment costs. However, this cannot be occurred because the figure of minus on O&M cost is not realistic. Therefore, the IRR is not likely to reach the benchmark of 13.125%.

+ Electricity tariff

The IRR reaches the benchmark when the tariff is increased by 22.21% which is 846.92 VND/kWh(5.13 US cent/kWh). This increase is not realistic for the following reasons. The electricity tariff of 693 VND/kWh(4.2 US cent/kWh) applied for the project has been defined in the FS report. The actual price will be defined in the PPA which will be signed only after the project starts generating electricity. The recent signed PPAs and MoUs between other independent power producers (IPP) and Electricity of Vietnam (EVN) show that the tariff has been in the range of 594-610VND/kWh (3.68-3.84 US cent/kWh) and it is not likely to reach 846.92VND/kWh (5.13 US cent/kWh) (Table B.4.Electricity tariff). Therefore, the IRR is not likely to reach the benchmark of 13.125%.

Table B.4.Electricity tariff

Plant No.	IPP	Installed capacity, MW	PPA/MoU date	Tariff	
				VND/kWh	US cent/kWh[6]
1	Confidential (PPA is available to be submitted to DOE)	28	December 2005	610 VND	3.84 US cent (at the rate 15,867 VND/USD on 15/12/2005)
2	Confidential (MoU is available to be submitted to DOE)	6.6	January 2007	594 VND	3.68 US cent (at the rate 16,120 VND/USD on 30/01/2007)
3	Confidential (MoU is available to be submitted to DOE)	9	January 2007	603 VND	3.74 US cent (at the rate 16,120 VND/USD on 30/01/2007)
4	Confidential (MoU is available to be submitted to DOE)	30	November 2007	607 VND	3.76 US cent (at the rate 16,131 VND/USD on 26/11/2007)
5	Confidential (MoU is available to be submitted to DOE)	18	April 2008	604 VND	3.78 US cent (at the rate 15,960 VND/USD on 2/04/2008)
6	Confidential (PPA is available to be submitted to DOE later)	16	February 2008	605 VND	3.76 US cent (at the rate 16,076 VND/USD on 15/02/2008)

These results show that only with highly unrealistic and very favorable circumstances would be possible to reach the IRR benchmark. In reality, circumstances typically occur more unfavorable than the project and the IRR would be even further away from the benchmark. We can conclude that the IRR is lower than the benchmark for a realistic range of assumptions for the input parameters of the sensitivity analysis, and therefore, the project is not financially attractive. This demonstrates that the project activity would not be implemented without the CDM.

[6] All exchange rates are official rates of the State Bank of Vietnam

Prior CDM

Table B.5. Timeline of Events

No.	Document	Date
1	Working minute between PO and local CDM consultant	13 Feb2007
2	Agreement for CDM services signed with local CDM consultant	2 Mar 2007
3	Final version of FS report	May 2008
4	Serious consideration of CDM – Investment decision of Director Board	19 Jun 2008
5	Contract of main construction (Start date of the project activity)	1 Apr 2009
6	Agreement for CDM services signed with consultant and authorisation to negotiate emission reduction credits sales signed with consultant	28 Apr 2009
7	Contract of the Equipment	20 May 2009
8	Submission of Notification to Vietnamese DNA and UNFCCC secretariat	24 Sep 2009
9	Approval for the PIN from Vietnamese DNA	13 Oct 2009

B.6. Emission reductions:

B.6.1. Explanation of methodological choices

Dak Me 1 hydropower plant has total capacity of 4 MW and uses renewable energy source to generate electricity and exports the generated electricity to the national grid. According to the approved methodology, AMS-I.D - Grid connected renewable electricity generation (version 14), there are two options for calculating the baseline emission as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the Emission Factor for an electricity system'.or

(b) The weighted average emissions (in tCO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The baseline emission of the project will be analysed and calculated using method (a) because the data for the year in which project generation accurs is not available.

Calculation of the baseline emission factor of the national electricity grid ($EF_{grid,CM,y}$)

According to the version 1.1 of "Tool to calculate the emission factor for an electricity grid", the baseline emission factor ($EF_{grid,CM,y}$) shall be calculated as one combined margin consisting of operating margin (OM) and build margin (BM) through the following six steps:

Step 1: Identify the relevant electric power system

The relevant electricity power system is that the national electricity grid that the project activity will connect to.

There are electricity imported from the China national electricity grid, thus the China national electicity grid is the connected electricity system and the emission factor for the imported electricity is zero tons CO_2 per MWh by default.

Step 2: Select an operating margin method (OM)

The calculation of the operating emission factor ($EF_{grid,OM,y}$) is based on one of the following method:

(a) Simple OM;

(b) Simple adjusted OM;

(c) Dispatch data analysis OM;

(d) Average OM.

The method "Dispatch data analysis OM" shall be the first option. However, dispatch data (detailed dispatch data) are not available. Therefore, this method cannot be used for calculation of emission factor OM.

From 2003 to 2007, in the structure of annual electricity generation of the national power grid, share of hydropower resources and low cost/must run sources based on generation are shown in the Table B.6. average of 37.02% in the last five years (2003 – 2007). Simple OM is appropriate because low cost/must run sources based on generation account for share lower than 50% of the total electricity generation in the national power grid in the latest five years.

Table B.6. Rate of low cost/must-run sources based on generation[7]

Year	2003	2004	2005	2006	2007	**Total**
Hydro power generation (GWh)	18,727	17,713	16,173	19,207	21,480	93,300
Biomass (GWh)	72	17	28	31	33	181
Import (GWh)	0	39	383	966	2,630	4,018
Total (GWh)	40,968	46,008	52,008	58,694	65,675	263,353
Rate of low cost/must-run sources generation, %	45.89%	38.62%	31.89%	34.42%	36.76%	37.02%

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.or

Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The OM emission factor of baseline shall be calculated by using method "ex-ante vintage" and shall be considered as constant over the first crediting period (7 year) of the project activity.

[7] Sources: Official confirmation from EVN

Step 3: Calculate the operating margin emission factor according to the selected method

Average operating margin emission factor shall be calculated based on weighted average value of thermal power generations in three latest years (2005, 2006, 2007), from which we obtained data at the time the project design is submitted.

The simple OM emission factor ($EF_{grid,\ OM\ simple,y}$) is calculated as the generation – weighted average CO2 emission per unit net electricity generation (tCO_2/MWh) of all generating power plants serving system, not including low-cost/must run power plant units. It may be calculated:

Based on data on fuel consumption and net electricity generation of each power plant / unit(Option A), or

Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or

Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C)

Since the fuel consumption of all the plants for the three latest years is not available (especially for the IPPs), Option A cannot be used. Therefore, Option B has been defined to apply.

The following formula is used to calculate Simple OM.

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

Parameter	Unit	Description
$EF_{grid,OMsimple,y}$	tCO_2/MWh	Simple operating margin CO_2 emission factor in year y
$EG_{,m,y}$	MWh	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y*.
$EF_{EL,m,y}$	tCO_2/MWh	CO_2 emission factor of power unit *m* in year *y*.
m		All power plants/units serving the grid in year *y* except low–cost/must–run power plants/units
y		The three most recent years for which data is available at the time of submission of the CDM–PDD to the DOE for validation

Again since fuel consumption of none of the plants is known accurately, the emission factor of each unit *m* is estimated using **Option B2** as provided in the Emission factor tool.

Option B2: **If for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows**:

$$EF_{EL,m,y} = \frac{EF_{CO2,\ y\ i,\ m} * 3.6}{\eta_{m,y}}$$

Where:

Parameter	Unit	Description
$EF_{EL,m,y}$	tCO_2/MWh	CO_2 emission factor of power unit *m* in year *y*.
$EF_{CO2,i,y}$	tCO_2/GJ	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y*
$EG_{m,y}$	MWh	Net electricity generated and delivered to the grid by power unit *m* in year *y*
$\eta_{m,y}$	%	Average net energy conversion efficiency of power unit *m* in year *y*
y		Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

Step 4: Identify the cohort of power units to be included in the build margin

The sample group of power units m used to calculate the build margin consists of either:

a) The set of five power units that have been built most recently, or

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

The comparison carried out by the project participants shows that the set of power capacity additions in the electricity system that comprise 20% of the system generation that have been built most recently has the larger annual generation (13,599GWh) than the set of five power units that have been built most recently in 2007 does (1,181GWh), and hence b) is employed.

In terms of vintage of data, Option 1 shall be chosen for the proposed project. Details are as follows:

- For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period.

Step 5. Calculate the Build Margin emission factor *($EF_{grid,BM,y}$)*

The build margin is calculated as the generation–weighted average emission factor (tCO_2/MWh) of a sample of power plants as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

Parameter	Unit	Description
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor in year *y*
$EG_{m,y}$	MWh	Net quantity of electricity generated and delivered to the grid by power unit m in year *y*
$FE_{EL,m,y}$	tCO_2/MWh	CO_2 emission factor of power unit m in year *y*
m		Power units included in the build margin
y		Most recent historical year for which power generation data is available

Step 6. Calculate the combined margin baseline emission factor $EF_{grid,CM,y}$

The baseline emission factor $EF_{grid,CM,y}$ is calculated as the weighted average of the operating margin and the build margin. Default weights of 50% for the first crediting period are used.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

Parameter	Unit	Description
$EF_{grid,BM,y}$	tCO_2/MWh	Emission factor of the build margin.
$EF_{grid,OM,y}$	tCO_2/MWh	Emission factor of the operating margin.
w_{OM}	%	Weighting of the operating margin emission factor. (Default of 50%)
w_{BM}	%	Weighting of the build margin emission factor. (Default of 50%)

Leakage (LEy)

According to AMS I.D Ver.14, leakage emissions are considered as zero for the proposed project as:

- No equipment is transferred from another activity
- Biomass residues are not required by the project to generate electrivity.

Therefore,

$$LEy = 0$$

Project emissions (PEy)

Methodology AMS I.D Ver.14 does not require the calculation of project emission reductions and hence these will not form part of the emission reductions calculation.

Therefore,

$$PEy = 0$$

Emission reductions of the project (ERy)

The emission reductions ERy in year y is the difference between baseline emissions (BE_y), emissions of the project (PE_y) and leakage (LE_y). The emission reductions are calculated as follows:

$$ERy = BEy - PEy - LEy$$

Where:

Parameter	Unit	Description
ER_y	$tCO_2/year$	Emission reductions in year *y*
BE_y	$tCO_2/year$	Baseline emissions in year *y*
PE_y	$tCO_2/year$	Project emissions in year *y*
LE_y	$tCO_2/year$	Leakage emissions in year *y*

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor of grid connected power generation in year y calculated using the latest version of the *"Tool to calculate the emission factor for an electricity system"*
Source of data used:	As per the "*Tool to calculate the emission factor for an electricity system"*
Value applied:	0.56786
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the *"Tool to calculate the emission factor for an electricity system"*
Any comment:	As per the *"Tool to calculate the emission factor for an electricity system"* Calculated as a weighted sum of the operating margin and the build margin.

Data / Parameter:	$EF_{grid,OMsimple,y}$
Data unit:	tCO_2/MWh
Description:	Simple operating margin CO_2 emission factor in year *y*
Source of data used:	As per the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.64293
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the *"Tool to calculate the emission factor for an electricity system"*
Any comment:	As per the *"Tool to calculate the emission factor for an electricity system"* Calculated as the Simple OM and fixed *ex-ante*.

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year *y*
Source of data used:	As per the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.49279
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the *"Tool to calculate the emission factor for an electricity system"*
Any comment:	As per the *"Tool to calculate the emission factor for an electricity system"* Calculated using option 1 and fixed *ex-ante*.

B.6.3. Ex-ante calculation of emission reduction:

The details of calculation of OM, BM and CM emission factors are provided in Annex 3.The summary of the results is presented below.

Baseline emissions

Calculate the Operating Margin emission factor(s) ($EF_{grid,OMsimple,y}$)

The operating margin emission factor is estimated as below.

Table B.7. Total generation and emission (2005-2007) on the Operating Margin

Parameter	Unit	2005	2006	2007
$\sum_m EG_{m,y}$	GWh	36,418	39,525	43,934
$\sum_m EG_{m,y} \times EF_{EL,m,y}$	$ktCO_2$	**23,526**	**25,377**	**28,169**

Then, average $EF_{grid,OM,y}$ for 2005-2007 is :

$$EF_{grid,OM,y} = \frac{23,526 + 25,377 + 28,169}{36,418 + 39,525 + 43,934} = 0.64293 tCO_2 / MWh$$

Based on the above calculations, the OM is estimated to be ***0.64293 tCO_2/MWh***.

Calculate the Build Margin emission factor *($EF_{grid,BM,y}$)*

The power generation by 26 power plant units (13 power plants) which were commissioned latest and that contribute to 20% of the annual generation in 2007 was 13,599GWh (As per the guidance in the Emission Factor Tool, since 20% capacity, i.e. 13,135GWh has to be accounted for). The cumulative CO_2 emission of these were 6,701 $ktCO_2$.

Thus the BM is estimated to be ***0.49279 tCO_2/MWh***.

Calculate the baseline emission factor *$EF_{grid,CM,y}$*

$$EF = w_{OM} \times EF_{OM} + w_{BM} \times EF_{BM}$$

The baseline emission factor will be:

$$EF = 0.5 \times 0.64293 + 0.5 \times 0.49279 = 0.56786 tCO_2/MWh$$

Therefore the CO_2 emission factor of the Vietnamese national grid is estimated to be ***0.56786 tCO_2/MWh***.

Based on the above results, baseline emissions are calculated as shown below:

BEy = EGy (MWh)* EFy(tCO_2/MWh)

= 18,800MWh * 0.56786 tCO_2/MWh

= 10,676tCO_2

Leakage

The project will result into no leakage.

$$L_y = 0$$

Project emissions

Because there is no emission through the small hydropower project activity, amount of the emission is zero.

$$PE_y = 0$$

Emission reductions

Emission reductions are calculated with the following formula:

$$ER_y = BE_y - PE_y - L_y$$
$$= 10{,}676 \ \ tCO_2 - 0tCO_2 - 0tCO_2$$
$$= 10{,}676 \ \ tCO_2$$

Table B.8. Summary of the calculated parameters

Parameters	Symbol	Unit	Value
1. Installed capacity	N	MW	4.00
2. Electricity is fed up grid in the next years		MWh	18,800
3. Baseline carbon emission			
The "approximate operating margin"	OM	tCO_2/MWh	0.64293
The "Build margin"	BM	tCO_2/MWh	0.49279
Baseline emission factor	EF	tCO_2/MWh	0.56786
Total baseline carbon emission per year		tCO_2	10,676
4. Total carbon emission of the project per year		tCO_2/year	0
5. Total leakage carbon emission per year		tCO_2/year	0
6. Total CO_2 emissions reductions in the next years		tCO_2/year	10,676
7. Total CO_2 emission reductions during the crediting period of 7 years		tCO_2	**74,732**

B.6.4. Summary of the ex-ante estimation of emission reductions

Table B.9. Emission reductions of Dak Me 1 hydropower project activity

Year	Estimation of the project activity emissions (tons CO_2)	Estimation of baseline emissions (tons CO_2)	Estimation of leakage (tons CO_2)	Estimation of overall emission reductions (tons CO_2)
2011	0	10,676	0	10,676
2012	0	10,676	0	10,676
2013	0	10,676	0	10,676
2014	0	10,676	0	10,676
2015	0	10,676	0	10,676
2016	0	10,676	0	10,676
2017	0	10,676	0	10,676
Total (tons CO_2)	**0**	**74,732**	**0**	**74,732**

B.7. Application of a monitoring methodology and description of the monitoring plan:

B.7.1. Data and parameters monitored

Data / Parameter:	EGy
Data unit:	MWh
Description:	Actual electricity supplied to the national power grid by the Project
Source of data to be used:	Direct measurement at the project site by metering system
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	18,800
Description of measurement methods and procedures to be applied:	Direct measurement by electronic equipment - Continuously measurement and monthly recording will take place - Data is electronically archived during the crediting period and 2 years later
QA/QC procedures to be applied:	Notebook recording the electricity supplied to the national power grid
Any comment:	

B.7.2. Description of the monitoring plan

According to procedures for hydropower projects in Vietnam, the examination, monitoring and management of a power plant are defined clearly in PPA between the project entity and PC3. But at the moment, the proposed project's PPA hasn't been concluded yet, so all concrete details of the monitoring plan are still not available, but in general the monitoring methodology has to comply with regulations as follows:

+ No monitoring for leakage
+ For emission reduction

The monitoring is carried out in accordance with AMS.I.D method Version 14 for small scale project activity and the Decision No. 37/2006/QD-BCN dated 16 October 2006 by Ministry of Industry.
The baseline grid emission factor will be calculated *ex ante* using historical data. After CDM registration it will be necessary to monitor electricity generation, including the possibility of imports from the EVN grid.

Management Structure of the CDM Project Activity

In order to meet the CDM monitoring and reporting requirements outlined above, the project management will appoint a CDM Coordinator at the project site to report directly to the General Manager. The CDM coordinator will supervise the following activities:

- Data collection and instrument calibration; and
- Preparation of emission reduction and monitoring reports for the purpose of verification.

The CDM Coordinator will be responsible for ensuring that data has been collected as per the requirement of this PDD and contains no errors.

- Data will be collected on a daily basis.

– Monitoring reports will be compiled on a monthly basis.

Schema of the management structure for project activity monitoring:

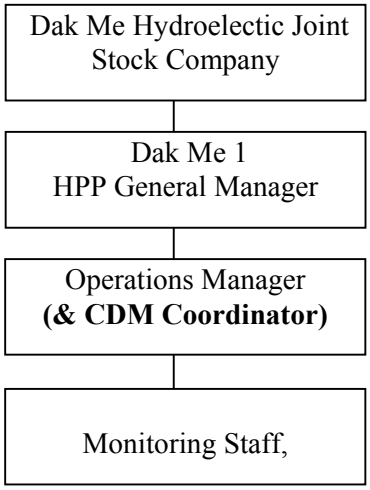

Figure B.3. Monitoring equipment and quality control

Grid connected electricity output will be monitored by use of a sealed and calibrated electricity meter installed in the substation that connects the project to the EVN's grid. Backup meters will be installed against the eventuality that the main meter fails.

According to the technical standard procedures used at EVN and/or MOIT, the meters will be properly recalibrated periodically by the monitoring staff. Irregularities or problems with the equipment will be reported to the management and rectified with due diligence. In the event of a failure of all the meters at the substation, net electricity output can be calculated by subtracting project site consumption from gross generation at the turbines.

Measurement records will be kept to ensure consistency. All the data will be stored in by the monitoring staff under the responsibility of the operation manager. Both hard paper copies and electronic copies will be kept. All records will be kept until at least two years after the end of the final crediting period. Receipts of electricity sales to PC3will be used as a final double-check to ensure that measurements are correct.

For the management of the plant operation, PO is going to make a detailed plan regarding to training and maintenance skill for operation workers in the plant and a training agreement will be signed between the PO and relevant partners. The agreement will include items as training cost, schedule, number of jointed people, etc. After completion of the training period, each of trainees will reach the practised certificated from the training partner.
In the emergency situation, used electricity in the plant will be provided by a battery system that is always available whenever.

B.8. Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion of the application of the baseline and monitoring methodology

Date: 19/10/2009

Name of person/entity determining baseline:

Kohei Obayashi

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SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

Starting date: 01/04/2009

C.1.2. Expected operational lifetime of the project activity:

30 years

Proposed operation starting date: 01/01/2011

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/01/2011

C.2.1.2. Length of the first crediting period:

7 year – 0 month

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Pursuant to the Decree No. 80/2006/ND-CP dated 09 August 2006 guiding on implementation of some articles of the Law on Environmental Protection, and Circular No. 08/2006/TT-BTNMT dated 8 September 2006 by Ministry of Natural Resources and Environment (MONRE) guiding on Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA) and Environmental Protection Commitment, hydropower plants which have reservoir capacity from 1,000,000 m^3 and above shall have to prepare EIA report. This project has reservoir capacity of 127,000 m^3, less than the above figure; therefore, it is not necessary to prepare EIA report.

However, preparation of the project activity, project registration and environmental protection commitment are required. So far, the project owner fulfilled all obligations specified in the above decree and circular. The particulars are as follows:

+ The project owner has received report of reviewing document "Environmental Protection Commitment" of the Dak Me 1 HPP in Da Long commune, Dam Rong district, certified by People Committee of Dam Rong district at the Paper No. 46/BC-TN&MT dated 20/7/2007.

+ The project owner has received certificate for registered environmental protection commitment from People Committee of Dam Rong district at the Decision No. 13/XN-UBND, dated 13 August 2007.

The summary of the environmental protection commitment is described as follows:

1.Positive impacts

The project will create new jobs for labour force in the area and local people will have opportunity to learn new techniques and production pattern,developing household economy.

The project will create new exchanges, economic development of the project area in particular and Lam Dong province in general.

Formation of reservoir will impact on natural conditions of the area.The micro climate regime will be formed. The area of forests and vegetation carpet will be changed.

2.Negative impacts

The construction such as roads, auxiliary structures, main structures will change landscapes, impacting on land resource in the construction site.

A huge of wastes will be produced such as solid, liquid wastes and dusts, noise. They will impact on the natural environment, ecological environment of the area.

3. Measures for overcoming negative impacts

a. for land

There is detailed planning of auxiliary areas, temporary camps, stores, dumpsites… in order to maximaiiy reduce impacts on land, plantation in the area.

Plan for restoration of area after construction completion

b. For water resources

Design water drainage, waste water collection systems for worker residential area.

c. For climate

Selection of appropriate construction equipment shall be performed in order to mitigate smoke, dusts and noise and to have measures for collection, transport and management of wastes in right places.

Implementation of regulations on labour safety and environmental hygiene during transportation of equipment and materials and construction process.

d. For bio-resources and ecological systems

Carrying out plans of reforestation in order to fast restore lost forest area and increase plantation areas.

Any construction of Dak Me 1 hydropower plant will have impacts on natural environment, socio-economic environment in the project area. The extent of impacts and damage will be compensated by the benefits which are brought by the project. Pursuant to the following environmental viewpoint, the project owner will avoid and mitigate the negative impacts.

- The least environmental damage
- Smallest number of residents to be resettled
- Area shall be convenient for arrangement of project layout
- Area is possible to be restored after completion of the project

This is a very small hydropower project with an small reservoir, therefore impacts on environment are not significant and specially there are only 2 households which have been moved to other place and 16 households which have been affected a part of there forming land. The project owner has been compensated residents for the occupied land and resettles nearby according to the laws, standards.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Project participants and the host country have not considered the above mentioned environmental impacts as significant and consider negative environmental impacts as minor. Therefore there is no support document attached hereby.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

On 2nd August 2008, the public consultation was carried out in Da Long Commune, Dam Rong district, Lam Dong province in compliance with the regulations on development of CDM projects and investment in power generation in Vietnam. The following communities were consulted with:

Representatives of the People Committee of Da Long commune

Representatives of mass root organizations of Da Long commune

Representatives of People of Da Long commune

Representatives of the project owner

Stakeholders were invited to join a meeting by invitation letters and these letter were given them by hand.

Across the consultation, presentations on summary of the project were made by the project owner in a non-technical and local language to local people.

All participants agreed that the project will contribute to positively impact on sustainable socio-economic development in remote mountainous areas for ethnic minorities.Therefore they fully support the project.

Moreover, the official support opinions of local organizations, departments are as follows

People Committee of Lam Dong province (the highest local authority) supports this project as the CDM activity by the Decision No. 3820/UBND dated 5/6/2009 and approved the request paper No. 443/TN&MT dated 1/6/2009 by the District Department of Natural Resources and Environment with conclusions as follows:

- Dak Me 1 HPP meets requirements specified in the Circular No. 10/2006/TT-BTNMT by MONRE guiding on development of CDM projects, ensuring socio-economic requirements, contributing in local sustainable development and environmental protection.
- People Committee of Dam Rong district (the highest local authority in Dam Rong district): supports this project as the CDM activity as mentioned in the Decision No. 251/UBND, dated 13/5/2009 by People Committee of Dam Rong district with the conclusions as follows: The project applies the appropriate technologies in compliance with sustainable energy development plan of the district and province, meeting all criteria of a CDM project.

Thus, all related stakeholders strongly support the project as the CDM project.

E.2. Summary of the comments received:

Comments of the local people and authorities on the project are as follows:

1. People understand the scope of Dak Me 1 hydropower project. People agree on location of dam, location of the power plant, internal roads and other items of the project.
   - Dak Me 1 hydropower project has sufficient conditions to be CDM project under the framework of Kyoto Protocol.
2. People aware that negative impacts of the project are not high and the project does not impact on their livelihood.

3. People understand the positive and negative impacts of the project and aware of obligations of environmental protection.
4. People understand the right of public supervision on environmental protection and measures for mitigation of the project's environmental impacts.
5. Construction of Dak Me 1 hydropower project will make development of Da Long commune economy, sufficient electricity supply. Roads will be developed to sub-area 65, sub-area 72. This makes easy travel and transport for people.
    - The project has also contribution in flood control in raining season and regulation of water serving production activities and coping with drought in dry season.
    - The environment will be cleaner, tourist landscapes will be created and socio-economic development in Da Long commune, Dam Rong district will be promoted.
6. The public consultation meeting on clean energy (CDM) of Dak Me 1 hydropower project recommends the People Committee of Dam Rong district, People Committee of Lam Dong province, MONRE to approve the CDM project for Dak Me 1 hydropower project, in order to make the project efficient and soon being put into operation and contributing in local socio-economic development.

E.3. Report on how due account was taken of any comments received:

The project owner assured and confirmed that:

- To implement all measures for environmental impact mitigation, environmental monitoring program as mentioned in the report.
- To ensure sufficient budget for environmental treatment, measurement, monitoring.
- To be responsible to the laws for any violation of Vietnam standards during investment, construction and any environmental pollution accident.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from the Annex 1 countries or ODA fund is involved in the project activity.

Annex 3

BASELINE INFORMATION

Calculations and Data for Vietnam Grid Emission Factor

a) *Calculation of operating margin EF_{OM} period 2005-2007*
b) *Calculation of build margin EF_{BM}*
c) *Calculation of combined margin EF_{CM}*

a) *Calculation of operating margin EF_{OM} period 2005-2007*

EVN Power plant

No.	Power Station	Fuel/ Technology	A	B			C=860/A	D	E=D*3.6/C	F=B*E		
			Heat Rate Kcal/kWh	Annual Generation GWh			Efficiency ηm,y%	$EFco_2$,m,fuel,y tCO_2/GJ	Fuel,m,y tCO_2/MWh	$ktCO_2$		
				2005	2006	2007				2005	2006	2007
1	Pha Lai 1	Coal/ST	3,037	2,462	2,767	2,830	28.32%	0.0983	1.2497	3,077	3,458	3,537
2	Pha Lai 2	Coal/ST	2,402	4,299	4,315	4,198	35.80%	0.0983	0.9884	4,249	4,265	4,149
3	Uong Bi	Coal/ST	3,877	669	759	694	22.18%	0.0983	1.5953	1,067	1,211	1,107
4	Uong Bi 2	Coal/ST	NA			520		0.0983		NA	NA	NA
6	Ninh Binh	Coal/ST	3,824	690	795	729	22.49%	0.0983	1.5735	1,086	1,251	1,147
7	Thu Duc											
	ST	FO/ST	2,694	550	472	603	31.92%	0.0774	0.8729	480	412	526
	(GT1,2,3,4)	DO/GT	3,056	34	32	70	28.14%	0.0741	0.9479	32	30	66
8	Can Tho											
	ST (S4)	FO/ST	2,709	128	128	137	31.75%	0.0774	0.8777	112	112	120
	(GT1,2,3,4)	DO/GT	3,056	142	109	151	28.14%	0.0741	0.9479	135	103	143
9	Ba Ria	Gas/CCGT	2,210	2,151	2,024	1,983	38.91%	0.0561	0.5190	1,116	1,050	1,029
10	Phu My 1	Gas/CCGT	1,746	7,179	6,422	8,077	49.26%	0.0561	0.4100	2,944	2,633	3,312
11	Phu My 2.1	Gas/CCGT	1,857	3,641	6,111	5,975	46.31%	0.0561	0.4361	1,588	2,665	2,606
12	Phu My 4											
	GT41,43	Gas/CCGT	1,829	3,126	3,209	3,277	47.02%	0.0561	0.4295	1,343	1,378	1,408
	EG of EVN's plants in 3 years			25,071	27,143	29,244	**Emission of EVN's plants in 3 years**			17,229	18,570	19,150

Thermal IPPs

No.	Power Station	Fuel/ Technology	A	B			C=860/A	D	E=D*3.6/C	F=B*E		
			Heat Rate Kcal/kWh	Annual Generation GWh			Efficiency ηm,y%	$EFco_2,m,fuel,y$ tCO_2/GJ	Fuel,m,y tCO_2/MWh	$ktCO_2$		
				2005	2006	2007				2005	2006	2007
1	Na Duong	Coal/ST	2,748	389	709	744	31.30%	0.0983	1.1308	440	802	841
2	Hiep Phuoc	FO/ST	3,232	1,424	955	1,726	26.61%	0.0774	1.0472	1,491	1,000	1,807
3	Formosa	Coal/ST	2,270	800	1,086	1,113	37.89%	0.0983	0.9341	747	1,014	1,040
4	Amatar	DO/ST	3,300	67	26	13	26.06%	0.0741	1.0236	69	27	13
5	Bourbon	Co-gen	2,700	43	57	69	31.85%	0.0983	1.1110	48	63	77
6	Ve Dan	Gas/GT	2,900	463	514	534	29.66%	0.0561	0.6810	315	350	364
7	Cai Lan	DO/ST	3,300			81	26.06%	0.0741	1.0236			83
8	Phu My 22	Gas/CCGT	1,573	3,719	4,855	5,004	54.67%	0.0561	0.3694	1,374	1,793	1,848
9	Phu My 3	Gas/CCGT	1,739	4,442	4,110	3,883	49.45%	0.0561	0.4084	1,814	1,678	1,586
10	Cao Ngan	Coal/ST	2,748		70	832	31.30%	0.0983	1.1308		79	941
11	Cà Mau	Gas/GT	2,583.2			691	33.29%	0.0561	0.6066			419
	EG of IPPs in 3 years			11,347	12,382	14,690	**Emission of IPPs in 3 years**			6,298	6,807	9,019

	2005	2006	2007
Total Emission($ktCO_2$)	23,526	25,377	28,169
Total EG(GWh)	36,418	39,525	43,934

$$EF_{OM} = (23,526 + 25,377 + 28,169) / (36,418 + 39,525 + 43,934) = \mathbf{0.64293\ tCO_2/MWh}$$

b) *Calculation of build margin EF_{BM}*

No.	Name of plant	Date of commisioning	Capacity	Technology	A	B	C=A*B
					Generation GWh	Fuel,m,y tCO_2/MWh	$ktCO_2$
1	Đai Ninh	Dec-07	150	Hydro	0	-	
2	Quang Tri	Nov-07	64	Hydro	64	-	
3	Se San 3A	May-07	108	Hydro	345	-	
4	Cà Mau	Apr-07	500	Gas/ GT	691	0.6066	419
5	Cái Lân	Mar-07	6x6.5	FO/ST	81	1.0236	83
6	Srokphumiêng	Jan-07	51	Hydro	252	-	
7	Uông Bí 2	Dec-06	300	Coal/STI	520	1.1308	588
8	Sê San 3	Jul-06	260	Hydro	1,130	-	
9	Cao Ngan	May-06	115	Coal/STI	445	1.1308	503
10	Na Duong	Apr-05	100	Coal/ST	744	1.1308	841
11	Phú My 2.2	Oct-04	763	Gas/GT	5,004	0.3694	1,848
12	Phú My 4	Sep-04	565	Gas/GT	3,210	0.4295	1,379
13	Formosa	Mar-04	150	Coal/STI	1,113	0.9341	1,040
	Total Generation of plants in BM calculation				**13,599**	**Total emission**	**6,701**
	Total Generation of the Vietnam electricity grid				**65,675**		
	20% of total generation of Vietnam electricity grid				**13,135**		

EF_{BM} = 6,761 / 13,599 = **0.49279 tCO_2/MWh**

c) *Calculation of combined margin EF_{CM}*

$$EF_{CM} = 0.5*EF_{OM} + 0.5*EF_{BM} = 0.5*0.64293 + 0.5*0.49279 = \mathbf{0.56786\ tCO_2/MWh}$$

Annex 4

MONITORING INFORMATION

As mentioned in the B.7.2, PPA is not available at this time, the following procedures therefore are in general.They are in line with the Vietnamese government's regulations.

Selection procedure:

The monitoring staffs will be appointed by the general manager of the Dak Me 1 Hydropower Project. The monitoring staffs will be selected from among the operation workers of the plant. Before commences monitoring duties, they have to joint a training on the operation and maintenance processing

Tasks and responsibilities:

The monitoring staffs will be responsible for carrying out the following tasks:

Supervise and verify metering and recording:

The monitoring staffs will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.

• Collection of additional data, sales / billing receipts:

The monitoring staffs will collect sales receipts for power delivered to the grid and billing receipts for power delivered from the grid to the hydropower station

• Calibration:

The monitoring staffs will coordinate with other staffs of the project entity to ensure that calibration of the metering instruments is carried out periodically in accordance with regulations of the EVN

• Calculation of emission reductions:

The monitoring staffs will provide with data and information that have been collected in the last operation period to the project's CDM consultant.

• Preparation of monitoring report:

The monitoring staffs will annually prepare a monitoring report which will include among others a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration and a calculation of emission reductions.