CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

Bac Ha Hydropower Project, Vietnam
Version 1.4
15/06/2011

A.2. Description of the project activity:

The project activity is to build and operate a hydropower plant with an accumulation reservoir on the Chay river. The project is located in the Coc Ly Commune, Bac Ha District - Lao Cai Province in Vietnam. It is 30 km from Lao Cai town and 320 km from Hanoi.

Bac Ha hydropower plant (Bac Ha HPP) is owned and built by the state owned company Bac Ha Hydropower JSC.

The dam will produce 378 GWh electricity per year, with an installed capacity of 90 MW[1]. The dam[2] has a reservoir area at maximum water level of 6.9km^2 with an energy density of around 13.0 W/m^2. A 220KV line Bao Thang will be built, which is synchronous with 220 kV line Bao Thang-Lao Cai. As long as the Bao Thang station has not been constructed yet from Bac Ha HPP to node G9A a 15 km long AC-300 wire and from G9A to Lao Cai station a 13 km long 2xAC-300 wire is connected. When the 220 kV Bao Thang station is finished, a 7 km long 2- circuit transmission line will be built with transistor coupling on the 220kV Bac Ha HPP -Lao Cai forming the 220 kV Bac Ha HPP-Bao Thang transmission line and the Bao Thang-Lao Cai transmission line. The project started construction in February 2005 and expects to enter into operations mid 2011.

The project will reduce GHG emissions by annually 215,906 tCO_2 by producing electricity with a renewable source thus substituting electricity produced in Vietnam to a large extent by fossil means.

The contribution to sustainable development is:

- Reduced GHG emissions through producing energy with a renewable source.
- Reduced local air pollution, especially particle matter and sulfur bio-oxide caused by thermal power plants, especially coal plants as used by Vietnam.
- Renewable energy sources and technology is promoted thus diversifying energy sources and securing energy supply for a sustained economic growth of Vietnam.
- Creation of 737 additional jobs during construction and 109 permanent jobs during hydropower plant operations[3].

[1] File 6, p. 2

[2] File 11, p. 2

[3] File 12

866 households with a total of 4,449 people were affected due to the project of which 66 households with 325 inhabitants had to be dislocated[4]. Compensation, support and resettlement have been given to these people. The project is also being evaluated for WCD (World Council on Dams) compliance and has realized all respective documentations.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Socialist Republic of Vietnam (host)	Bac Ha Hydropower Joint Stock Company (state-owned corporation)	No
Switzerland	ecotawa AG (private entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Socialist Republic of Vietnam

A.4.1.2. Region/State/Province etc.:

Lao Cai Province

A.4.1.3. City/Town/Community etc.:

Coc Ly Commune, Bac Ha District

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

Power house: 22°30'24"N 104°11'42"E

[4] File 13

Map 1: Project Site

A.4.2. Category(ies) of project activity:

Sectoral scope / Category 01: Energy industries (renewable sources)
Grid-connected electricity generation from renewable sources

A.4.3. Technology to be employed by the project activity:

The hydropower plant has two hydraulic turbines. The total generation capacity is 90 MW. The hydropower plant is based on an accumulation reservoir.

Table 1: Characteristics of the Hydropower Plant

Parameter	Unit	Value
Capacity turbines[5]	MW	90
Maximum rated flow rate[6]	m^3/s	187

[5] Based on technical FSR (File 6), p.2.

[6] File 11, p. 2

Annual production hours[7]	hours	4,204
Average annual power production for grid[8]	MWh	374,576

Table 2: Characteristics of the Reservoir

Parameter	Unit	Value
Reservoir area at maximum water level	km^2	6.9
Total capacity	million m^3	171.1
Useful capacity	million m^3	103.8
Power density	W/m^2	13.0
Length of dam	meter	9
Maximum height of dam	meter	77.6

Source: File 11, p.2. (for maximum water level based on figure below)

Figure 1: Maximum Reservoir Area Calculation

Z (m)	F (km^2)	W (tr m^3)
118.9	0.00	0.00
125	0.60	1.22
130	0.83	4.78
135	1.14	9.67
140	1.67	16.64
145	2.03	25.86
150	2.48	37.09
155	3.04	50.85
160	3.57	67.35
165	4.52	87.51
170	5.08	111.47
175	5.97	139.05
180	6.90	171.17
185	7.96	208.28

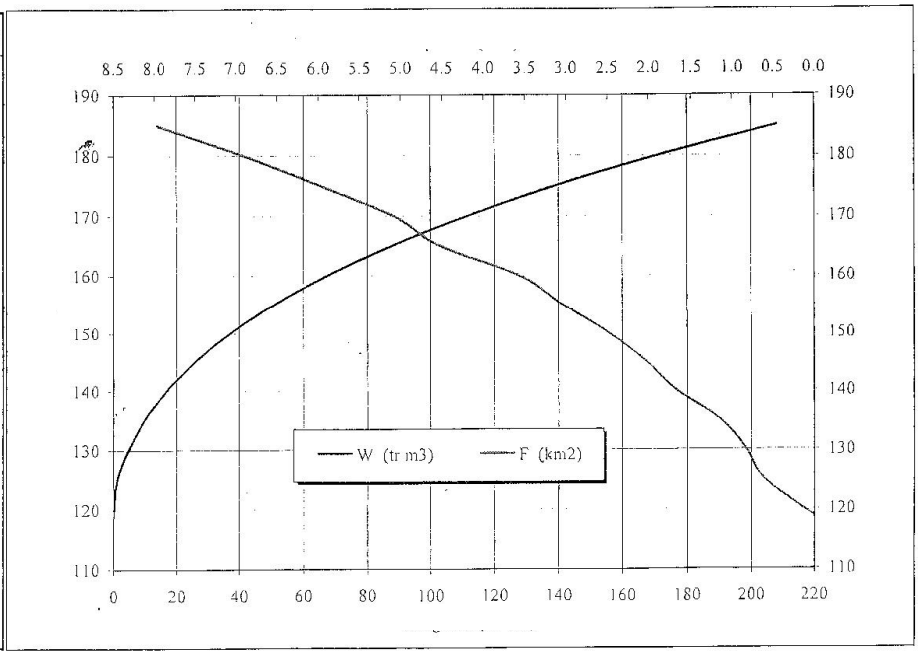


Table 3: Equipment

Equipment	Specifications
Turbines	2 hydraulic turbines produced in China by Tianjin Tianfazhongxing with an assembly capacity of 46.4 MW each and a rated capacity of 45 MW[9]
Generators	2 vertical sync generators of each 53 MW (power factor 0.85) produced in China by

[7] FSR, 2004, (File 7), p.2-12

[8] Production capacity (90*4,240) minus 1% internal electricity usage based on FSR, 2004, p. 22-6 (File 4)

[9] File 14, Annex 6, p. 4/196

	Tianjin Tianfa[10]
Transformer	2 oil immersed transformers of 63 MVA 13.8/230 kV produced by EEMC in Vietnam[11]
Grid connection and transmission line	According to central power planning a 220KV line Bao Thang will be built, which is synchronous with 220 kV line Bao Thang-Lao Cai. As long as the Bao Thang station has not been constructed yet from Bac Ha HPP to node G9A a 15 km long AC-300 wire and from G9A to Lao Cai station a 13 km long 2xAC-300 wire is connected. When the 220 kV Bao Thang station is finished, a7 km long 2- circuit transmission line will be built with transistor coupling on the 220kV Bac Ha HPP -Lao Cai forming the 220 kV Bac Ha HPP-Bao Thang transmission line and the Bao Thang-Lao Cai transmission line[12].
Back-up facility	Backup source includes a transformer of 1,000 kVA - 35/0.4 kV, connecting to 35 kV grid and a diesel generator of 500 kVA. A battery set 220V DC/500Ah, and a battery set 48VDC is used for operation of equipment and also as backup source in case of AC power cut[13].

Source: Turbines and generators File 19, attachment 1, bid schedule 2.1 and for grid connection file 14, p.2

Generators and turbines are imported from China. They therefore contribute to the sustainable development aspect of the project via technology transfer.

Figure 2 shows a general plant layout.

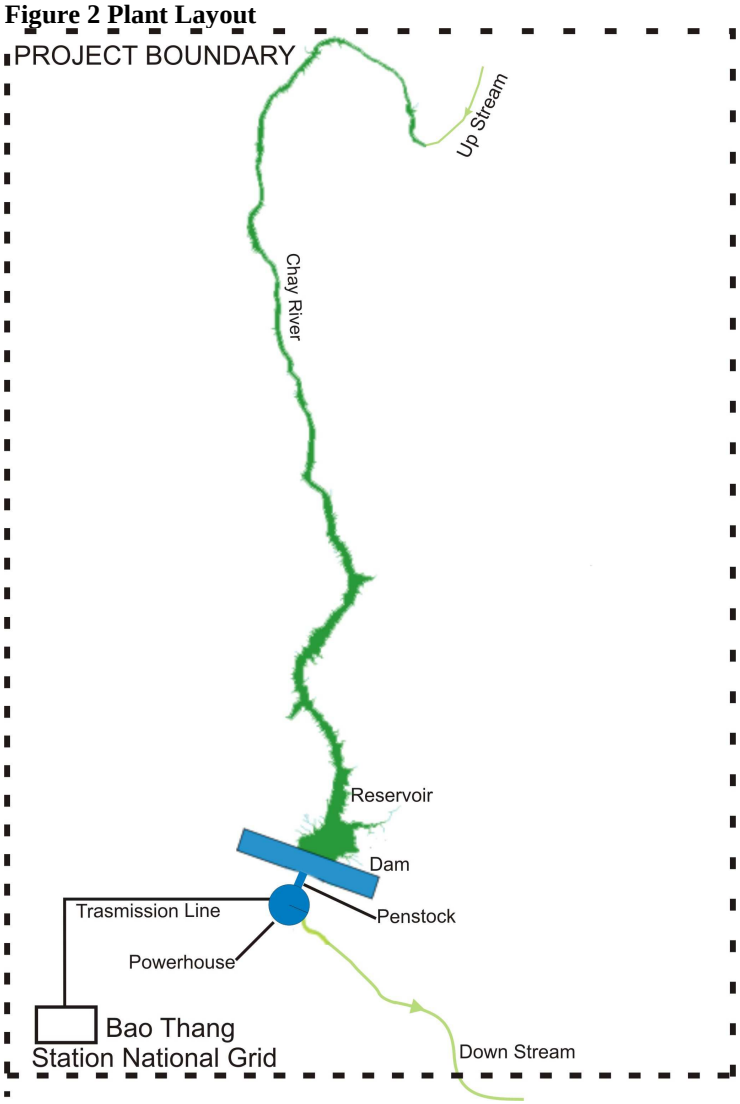
[10] File 14, Annex 5, p. 4/16

[11] File 14, Annex 3, p. 5/6 and Annex 6 p.57/196

[12] File 15, p.1

[13] File 16, chapter 8, p12-13/14

Figure 2 Plant Layout



A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Years	Estimation of annual emission reductions in tCO_{2eq}
2011	107,953
2012	215,906
2013	215,906
2014	215,906
2015	215,906
2016	215,906
2017	215,906
2018	107,953
Total estimated reductions (tonnes of CO_{2eq})	**1,511,342**
Total number of crediting years	7

Annual average of the estimated reductions over the crediting period (tCO_{2eq})	**215,906**

A.4.5. Public funding of the project activity:

There is no Official Development Assistance in this project and the project will not receive any public funding from Parties included in Annex I.

SECTION B. Application of a baseline and monitoring methodology

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

Applied methodology

ACM0002 Version 12.1.0: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

Related tools

- "Tool to calculate the emission factor for an electricity system" Version 02.2.0
- "Tool for the demonstration and assessment of additionality" Version 05.2

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The proposed project is a grid-connected renewable power generation project activity that installs a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant) applicable to ACM0002. The applicability conditions of the methodology are related with the project in table 4.

Table 4: Applicability Conditions and Project Situation

Applicability condition	Project situation
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The project is the installation of a new hydro power plant with an accumulation reservoir.
In case of hydro power plants, one of the following conditions must apply: - The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or - The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or	The project activity results in a new reservoir with a power density of 13.0 W/m^2.[14]

[14] See for reservoir areas File 11, p. 2

- The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	

All applicability criteria are thus met.

B.3. Description of the sources and gases included in the project boundary:

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table 5.

Table 5: Emissions Sources Included in or Excluded from the Project Boundary

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emissions source
		N_2O	No	Minor emissions source
Project activity	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emissions source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emissions source

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The baseline scenario is the electricity delivered to the grid by the project activity which 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 (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

Chapter B.6. includes the calculation of the CM. For formulas see chapter B.6.

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 CDM project activity (assessment and demonstration of additionality):

The additionality of the project is determined using the latest Version of the "Tool for the demonstration and assessment of additionality" (Version 05.2).

The project starting date is defined as the date on which the construction contract was signed being 21.02.2005. The project activity thus started prior validation and prior 2.8.2008 and is thus considered an existing project activity in line with EB 49 Annex 22 (section C of guidelines).

Based on section C part a) of EB 49 Annex 22 the following table shows awareness of the CDM of the project participant prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project.

Table 6: Prior Consideration Part A

Date	Milestone	Documentary Proof
28/04/2004	Directive No.4124/TCT-QLDA of the General Director to identify a CDM consultant	Directive (File 19)
25/01/2005	Establishment of a CDM board	Official letter No.04/TĐBH/KT-KH (file 34)
21/02/2005	Project starting date: Signature of construction contract	Contract (File 18)

The Board meeting April 2004 identified CDM as a financial resource to overcome the barriers including financial barriers to the project implementation and recommended the identification of a consultant which also assumes all risks and costs of the CDM process. The project owner established even before project start already a CDM board with clear responsibilities for involved persons. These two actions clearly show that the project proponent was aware of the CDM and that CDM was considered as decisive to overcome the barriers to project implementation. To secure CDM even a Board was created by the company.

Based on section C part b) of EB 49 Annex 22 the following table shows by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.

Table 7: Prior Consideration Part B

Date	Milestone	Documentary Proof
21/02/2005	Project starting date: Signature of construction contract	Contract (File 18)
18/12/2006	MoU with Carbotech AG for CDM project development	MoU (File 20)
15/05/2008	MoU with ecotawaAG for CDM project development	MoU (File 48)
24/06/2009	CDM project development contract	Contract (file 21)
09/2010	GSC at UNFCCC	UNFCCC website
July 2011	Expected operational start of project	

After project start first a MOU was realized with Carbotech AG. Later this was changed to ecotawa which after careful project due diligence realized a CDM development contract with the project proponent. During 2009/2010 ecotawa collected all data required including the calculation of the combined margin and all the information required for the World Council on Dam (WCD) compliance report as this is a requirement to sell the CERs in the European market. Especially latter requires a large amount of additional information which needs to be collected at project site[15]. As the project will only generate CERs from mid 2011 onwards the project developer was in no rush to terminate the project as validation and registration costs occur upfront and therefore for cash balance reasons it is advisable to realize the registration just before operational start. The project owner has thus shown clear steps of continuous action with less than 2 years between actions in line with point 6b of EB 49 Annex 22 which states: "Evidence to support this should include, *inter alia*, contracts with consultants for CDM/PDD/methodology services, Emission Reduction Purchase Agreements or other documentation

[15] SQS is validating simultaneously the WCD report prepared for the HPP.

related to the sale of the potential CERs (including correspondence with multilateral financial institutions or carbon funds)».

STEP 1. IDENTIFICATION OF ALTERNATIVES TO THE PROJECT ACTIVITY CONSISTENT WITH CURRENT LAWS AND REGULATIONS

Sub-step 1a: Define alternatives to the project activity

Paragraph 4 of version 05.2 of the additionality tool states: "Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is *at least one credible and feasible alternative* that would be more attractive than the proposed project activity."

Therefore following two scenarios are considered:

- Alternative 1: The proposed project undertaken without the CDM;
- Alternative 2: Continuation of the current situation with power from the Vietnamese grid.

Sub-step 1b: Consistency with mandatory laws and regulations

Alternative 1 is theoretically technically feasible and complies with Vietnamese current laws and Regulations. Alternative 2 does not face with any barrier from the current law and regulation because the project owner has no obligation to build or invest in the power plant to supply electricity for the local area.

Step 2. Investment analysis

The steps used and the procedures follow the Guidance on the Assessment of Investment Analysis as included as Annex in the methodological tool "Tool for the Demonstration and Assessment of Additionality" Version 5.2.

Sub-step 2a: Determine appropriate analysis method

Options include:

1. Simple cost analysis
2. Investment comparison analysis
3. Benchmark analysis

The project activity generates income other than CER revenues. Thus option 1 is not appropriate. The 2 options included are the project with or without revenue of CER. The baseline case has no investment. Thus the investment comparison analysis is not appropriate. Therefore the option 3 benchmark analysis is chosen as appropriate analysis method.

Sub-step 2b – Option III: Apply benchmark analysis

Determine Suitable Indicator

The financial/economic indicator chosen is the IRR as it is considered as the most suitable indicator for the project type. The IRR is taken as it can be easily compared to a financial benchmark. The IRR is capable of comparing the investment decision of the project with a financial benchmark and thus gives an indication of the financial profitability of the investment.

The financial analysis is based on a standard market parameter as benchmark. As benchmark the commercial lending rate used in Vietnam is used. The State Bank of Vietnam (SBV) fixes the maximum loan interest rate. All commercial banks applied this same maximum commercial interest rate. This rate was 11.7% in VND at the time of financial analysis[16]. The benchmark is lower than the IMF commercial lending rate for 2005 being 13.6%[17]. The benchmark is thus clearly justified and conservative.

Sub-step 2c: Calculation and comparison of financial indicators

The principles used for all calculations and their compliance with EB guidance is shown in the following table.

Table 8: Investment Principles and EB Guidelines[18]

EB Guideline[19]	Project
Points1 and 2: General introduction of Guidance	
Point 3: Period of assessment	The period of assessment taken is 25 years of operation (total 30 years including construction). According to the guidance "In general a minimum period of 10 years and a maximum of 20 years will be appropriate." The project is taking a longer period which is more conservative. The salvage value at the end of the period is included based on the technical life-span.
Point 4: Salvage value	The salvage value is included. The technical life-span was taken based on EB 50 Annex 15 as 150,000 hrs for hydro turbines (generators and transformers 30 years; to be conservative for all equipment the 150,000 hours was taken which is 36 years at annual operating hours). For construction the salvage value is based on the lifespan of 40 years according to Decision No. 2014/QD-BCN dated 13 June 2007 by the Ministry of Industry[20]
Point 5: Depreciation and other non-cash items	Depreciation and other non-cash items such as amortization are not included when calculating the IRR. Taxes and duties have not been included. This is in line point 11 as the IRR is calculated pre-tax as recommended in this point.
Point 6: Time of assessment	All input values are based on data available as of February 2005. The decision was taken after the approval of the technical design stage 1

[16] Commercial interest rate is idem to base rate of State Bank of Vietnam which is 7.8% plus 50%; Base rate source: State Bank of VietnamFile 1

[17] IMF, 2007, Table 21, p. 24 (fixed capital, medium term), File 2

[18] Based on EB 51 Annex 58 „Guidelines on the Assessment of Investment Analysis" Version 03

[19] Tool for the demonstration and assessment of additionality, Version 5.2. Annex: Guidance on the Assessment of Investment Analysis Version 04

[20] File 3

	(File 6). At this time the feasibility study Version 1 was available (11.2004, File 4) and a MOU for electricity selling had been signed (10/2004) (File 5).
Point 7: Cesation of implementation	Not relevant for project
Point 8: Provision of spreadsheet	Spreadsheet is provided.
Point 9: Finance expenditures	Financing expenditures are not included when calculating the IRR (see point 5).
Point 10: Equity IRR	Project IRR and not equity IRR is calculated.
Point 11: Taxation	Taxation is not included and a pre-tax benchmark is applied.
Point 12-18: Selection of benchmark	The applied benchmark is the local commercial lending rate as a project IRR is used. The benchmark is based on publicly available data sources of the State Bank of Vietnam. No internal company benchmark is used.
Point 19: If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.	A benchmark approach is used.
Point 20: Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation.	Sensitivity analysis is made assuming following changes: • 10% lower investment costs • 10% lower operational costs • 10% higher income from electricity sale These are all important cost/revenue variables.
Point 21: The DOE should assess in detail whether the range of variations is reasonable in the project context. Past trends may be a guide to determine the reasonable range. As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%.	The sensitivity analysis is made in a range of ±10%. Additionally an ex-post assessment is made and a cross comparison if data ranges and their variations are plausible

Data presented is based on the feasibility report (FSR) 2nd version as issued November 2004. Thereafter new versions were realized with changing costs (see sensitivity analysis). The following table shows the core data used for the financial assessment.

Table 9: Core Data Used for Financial Assessment (Date investment decision 15/02/2005)

Item	Unit	Value	Data Source
Local commercial lending rate	Percentage	11.7%	Base rate of State Bank of Vietnam is 7.8% plus 50%[21] Date: Decision 93/QĐ-NHNN dated 27/01/2005
Period of assessment	Years	30	According to guidance point 3 a maximum period of 20 years is considered as appropriate. Taking 25 years of operation and a total of 30 years including construction is thus very conservative. The fair value

[21] Base rate source: Document 25, State Bank of Vietnam; See File 1. The IMF published for 2006 a nominal interest rate in Vietnam of 13.7% which is higher than the base-rate used therefore showing the conservativeness of the base rate (see file 2)

			at the end of the period is included.
Salvage value - Construction - Equipment	Million VND	193,895 122,798	The technical life-span was taken based on EB 50 Annex 15 as 150,000 hrs for hydro turbines (generators and transformers 30 years; to be conservative for all equipment the 150,000 hours was taken which is 36 years at annual operating hours). For construction 40 years was taken which is even more conservative
Operating hours	Hours	4,204	Based on FSR Annex, (File 7), p.2-12 realized by an external company Date of document: 06/01/2005
Total electricity generated per annum	MWh	378,360	Calculated with operating hours and 90 MW capacity
Internal usage of electricity	Percentage	1%	FSR Vol 1, , p. 22-6 (File 4) Date of document: 28/11/2004
Electricity sold to the grid per annum	MWh	374,576	Calculated based on total produced minus internal usage
Electricity sale price	tsd VND / MWh	593	Based on MOC signed with EVN, 2004 File 5 p.1 Date of document: 22/10/2004
Annual operational cost	Percentage	0.5%	FSR, Vol 1, p. 22-6 (File 4) Date of document: 28/11/2004
Investment	Million VND	1,470,077	See details table 10.
Natural resources tax	Percentage	2%	2% of electricity output valued at the selling price (se above) based on Ministry of Finance Decree No.68/1998/ND-CP dated September 3, 1998 on Regulating in detail the implementation of the amended Ordinance on Resource Tax Art 7 point 3and Annex number VII point 2 (see File 9new)Date of document: 03/09/1998
Price of CERs	tsd VND /tCER	167	11 USD based on estimate of World Bank projection 1.2004 p. IV (File 10); USD to VND exchange rate based on median exchange rate mid February 2005 based on www.oanda.com/convert/classic Projection for date 1.2004

All the input values used in the investment analysis (such as values used for the benchmark calculation, operating hours, internal consumption and total investment) were thus clearly applicable at the time of investment decision.

Table 10 shows the investment detail of the project.

Table 10: Investment Detail (million VND)

Item	Investment
Construction cost	775,579
Equipment cost	410,239
Miscellaneous incl. construction preparation	150,616
Backup	133,643
Total	**1,470,077**

FSR, file 4 p 21-7, 28/11/2004

The IRR baseline is 10.6% and thus significantly lower than the benchmark of 11.7%.

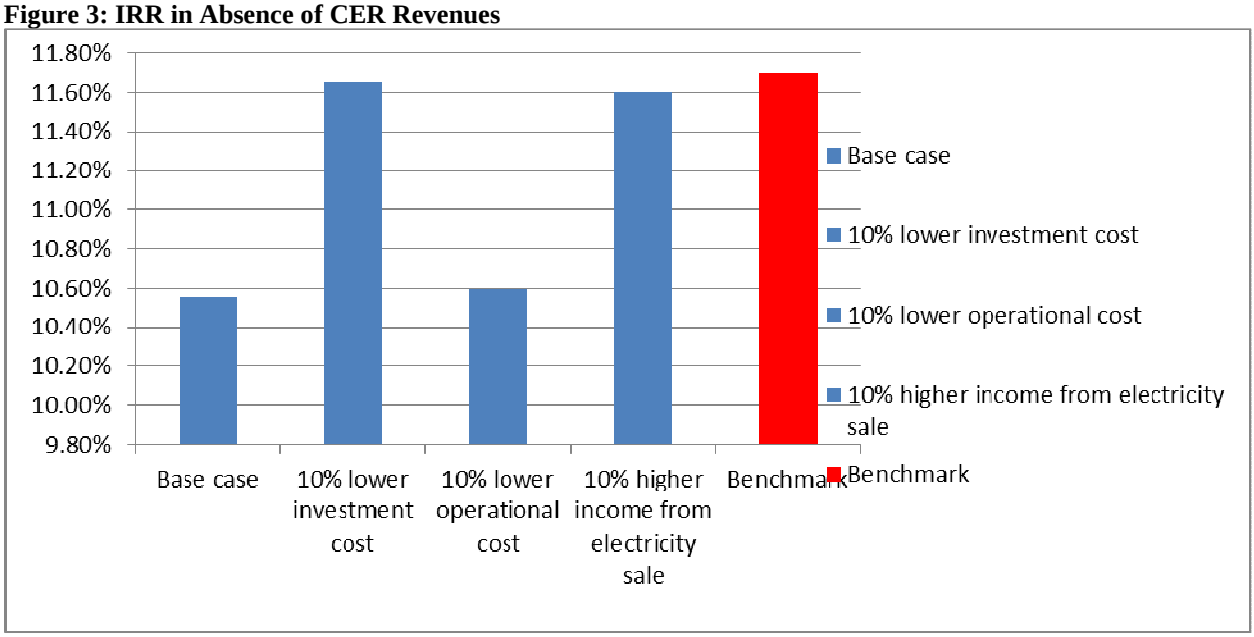
Sub-step 2d: Sensitivity analysis

Table 11 and figure 3 show the financial profitability of the investment in absence of the CER including the sensitivity analysis and comparing the values with the benchmark. In all cases the IRR is below the benchmark.

Table 11: IRR Base Case and Sensitivity to Parameter Changes Excluding CER Revenues

Case	IRR
Base case	10.56%
10% lower investment cost	11.66%
10% lower operational cost	10.60%
10% higher income from electricity sale	11.60%
Benchmark	**11.70%**

Figure 3: IRR in Absence of CER Revenues



In all cases the IRR is lower than the benchmark i.e. the project in absence of CDM is financially non-feasible.

Calculations done are conservative as also indicated by following elements:

- The latest investment calculation dated August 2009 showed a 51% higher investment than the one originally planned end 2004[22]. With this investment level the IRR would be 6.5% and thus 38% lower than the original value. This clearly shows that the investment value taken for calculation purposes is very conservative and that it is highly improbable that the investment cost

[22] Original investment FSR, file 4 p 21-7, 2004 and investment as of 8.2009 22, p. 3

would be lower than anticipated. The cost increase was due among others to a doubling of compensation costs[23] and a doubling of road construction costs[24].

- While the investment cost increased by 51% the last assumed price paid for electricity has only increased by 9% from 593 VND/kWh[25] to 646 VND/kWh[26]. Taking the last investment cost and the last price assumption the IRR of the project would be 7.3% instead of 10.5% i.e. 30% lower than the originally anticipated IRR.
- Insurance costs have not been included as no quote is available yet to proof data.
- No tax and finance costs have been included for calculation of the IRR. With tax costs the IRR will however decrease.

The above listed points show that the IRR and the data used for calculating latter are very conservative and that fluctuations leading to a higher either through a lower investment cost or significantly higher electricity prices are highly improbable based on the actual development of these parameters since project starting date proofed with new data sources.

With the CDM the project is however profitable and financially feasible as can be seen in the following table. The access to CDM finance is thus decisive for project success and implementation.

Table 12: IRR with and without CER Revenues

	IRR
IRR base case without CER revenues	10.6%
IRR with CER revenues	12.2%
Benchmark	11.7%

With CDM the project is clearly profitable and above the benchmark. The CER revenues are thereby estimated very conservatively with a price of 11 USD/tCO_2 which is significantly lower than prices currently paid.

Step 3 (Barrier analysis) is not performed.

Step 4: Common practice analysis

The above additionality test is complemented with an analysis of the extent to which the proposed project type has already diffused in the relevant sector and region.

Sub-step 4a: Analyze other activities similar to the proposed project activity

According to the Vietnam Construction Code – TXDVN 285:2002[27] hydropower projects are categorized. Furthermore, according to Decision of Ministry of Industry No 3454/QĐ-BCN dated 18

[23] Former File 23 p. V-2, new file 22 p.3

[24] Original file 24, p. 6/7 and new file 25

[25] File 5

[26] file 26, p. 3

[27] File 27

October 2005 on development plan of small-scale hydropower projects, hydropower projects having installed capacity within the range of 1 to 30 MW are categorized as small scale projects Art. 1). The categorization below takes account of these regulations.

Table 13: Hydropower Project Groups Detailed

Group	Installed capacity
A	≥ 300 MW
B	≥ 100 MW and < 300 MW
C	≥ 50 MW and < 100 MW
D	≥ 30 MW and < 50 MW
E	≥ 5 MW and < 30 MW
F	< 5MW

Source: Vietnam Construction Code – TXDVN 285:2002 (File 28) Ministry of Industry No. 3454/QD-BCN, 2005 (file 28)

In 2004 the government promulgated a new strategy on the development of electricity sources in Vietnam[28]. According to this strategy the market is liberalized and the role of EVN is basically limited to hydro-power projects larger than 100 MW (Art. 3). Due to changes in the market structure therefore power plants commissioned 2004 or later are compared with the proposed project. The comparable project category based on the categorization of the MOI and Vietnam Construction Code is thereby hydro power projects with an installed capacity of between 50 and 100 MW. The following table lists operational hydropower projects with these capacities prior validation start.

Table 14: Hydropower Projects Vietnam ≥50 and <100MW Capacity since 2004

Plant	Commissioning date	Installed capacity (MW)
Can Don[29]	2004	78
Srokphumieng[30]	2006	55
Quang Tri	2007	64
Pleikrong	2009	50
Buon Tua Srah	2009	86
Song Con[31] (CDM project)	2009	63

Source: EVN, 2009 Annex 1 and 7 (File 32)

3 of the 6 plants are non-EVN i.e. are financed and operated by a private entity. Private entities have other sources of finance and operate under different circumstances than a state-owned company and are thus not comparable to the proposed project.

Song Con is a CDM project and thus not included in the comparison[32].

Sub-step 4b: Discuss any similar Options that are occurring

[28] DECISION No. 176/2004/QD-TTg OF OCTOBER 5, 2004; File 29

[29] Non EVN

[30] Non EVN

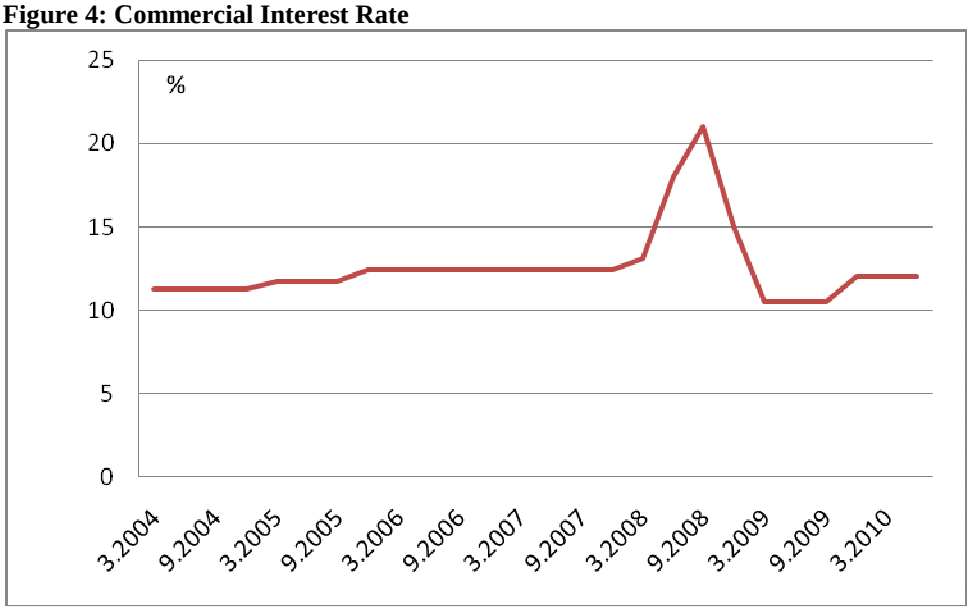
[31] Non EVN

[32] http://cdm.unfccc.int/Projects/Validation/DB/K6NPSU8C9X8UA9FMD1YHRIFUVEXLZW/view.html

The Master Plan for Electricity EVN shows that hydro looses importance from generating around 40% in the year 2010 to 27% in the year 2020 while coal increases considerably[33]. This is a clear indication that thermal power projects have a higher priority and are considered more attractive while hydro is not common practice.

Projects which have been commissioned since mid 2007 with the construction and thus financing period between 2007 and 2010 (including Bac Ha which is being constructed in this period) face a singular problem not experienced by projects which commenced earlier and where thus able to start operations 2009 or earlier (the first three projects listed in the former table started operations prior end 2007 and thus prior to start of the financial crisis). Vietnam experienced a period of high inflation rates not experienced previously[34] and consequently high interest rates as well as a drying up of liquidity. Figure 4 shows the development of the commercial interest rate over time.

Figure 4: Commercial Interest Rate



Source: State Bank of Vietnam (File 1)

Figure 4 is a clear indication of the difficulty large scale investment projects with a long gestation period and a large initial investment and therefore being sensitive to interest rates have. Projects already commissioned prior 2007 have experienced less this difficulty and are thus in a different situation than the proposed project which has its construction period in a high interest period thus affecting significantly it performance.

Taking into consideration the small amount of comparable non-CDM projects (5 units) and that 2 of these have a different ownership structure while the other did not face the full blast of the significant rise

[33] EVN File 30

[34] Inflation rates 2002 to 2006 were between 4 and 8%, See IMF, 2007 p. 3 data 2002 to 2006 (File 2) and surged to 23% in 2008 (IMF, 2009, table 1, File 31)

of interest rates and in light of the decreasing relative importance of hydro-projects in Vietnam for total electricity generation the proposed project is considered as not common practice.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

PROJECT ACTIVITY EMISSIONS

Project activity emissions are 0.

The power density of the project is greater than 10 W/m^2 and therefore

$$PE_{HP,y} = 0 \quad (1)$$

Where

$PE_{HP,y}$ Project emissions from water reservoirs (tCO_{2e}/yr)

The power density of the project activity (*PD*) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (2)$$

Where:

PD Power density of the project activity (W/m^2)

Cap_{PJ} Installed capacity of the hydro power plant after the implementation of the project activity (W)

Cap_{BL} Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ} Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL} Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

The hydropower project is new and thus the baseline parameters included are 0.

BASELINE EMISSIONS

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad (3)$$

Where:

BE_y Baseline emissions in year *y* (tCO_2/yr)

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)

$EF_{grid,CM,y}$ Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The project is a greenfield plant and thus:

$$EG_{PJ,y} = EG_{facility,y} \quad (4)$$

Where:

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)

$EG_{facility,y}$ Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Step 1: Identify the relevant electricity systems

The project is grid-connected to the national grid. Vietnam has one national grid. This is defined as the relevant electricity power system.

For imports from connected electricity systems located in another host country(ies), the emission factor is 0 tons CO_2 per MWh.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option I is chosen and only grid power plants are included in the calculation.

Step 3: Select a method to determine the operating margin (OM)

The simple OM is used (method a). According to the Tool any of the four methods can be used, however, the simple OM method can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in the average of the five most recent years. No geothermal, wind, nuclear and solar generation facilities connected to the grid are operating.

Table 15: Low-Cost/Must-Run Power Plants in Vietnam (2004-2008)

	2004	2005	2006	2007	2008
Hydro low-cost/must run MWh	17.858.651	16.365.438	19.508.244	22.385.232	25.933.762
Total generation GWh	44.974.169	50.330.468	57.160.493	66.348.589	74.689.636
Percentage low-cost/must run	39,71%	32,52%	34,13%	33,74%	34,72%

Source: MONRE, official CM, table 2 (File 49)

Low-cost/must-run facilities had on average 34.77 of total electricity generation and thus clearly less than 50% of total grid generation.

The ex-ante option is taken based on a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PDD to the DOE for validation.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants. The ex-ante option is taken based on a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PDD to the DOE for validation. The data vintage taken is 2006-2008. The data is based on the official data for the Combined Margin in Vietnam.

Data per power plant on fuel consumption is available based on fuel usage per kWh (plant efficiency). Therefore Option A is employed.

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (5)$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in the year *y* (tCO_2/MWh)
m	All power units serving the grid in year *y* except low-cost/must run power plants / units
y	Last 3 years available

The emission factor is determined as follows for plants where the fuel consumption is known (Option A1):

$$EF_{EL,m,y} = \frac{\sum_{i,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \quad (6)$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in the year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value of fossil fuel type *i* in the year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in the year *y* (tCO_2/GJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	All power units serving the grid in year *y* except low-cost/must run power plants / units
i	All fossil fuels combusted in power unit *m* in year *y*
y	Last 3 years available

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

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \quad (7)$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	All power units serving the grid in year *y* except low-cost/must-run power units
y	Last 3 years available

Step 5:
Calculate the build margin emission factor

Option 1 is chosen: 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.

Capacity additions from retrofits of power plants are not be included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin is determined as per the following procedure, consistent with the data vintage selected above:

a). Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);
b). Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET $\geq$ 20%) and determine their annual electricity generation (AEGSET $\geq$ 20%, in MWh);
c). From SET5-units and SET $\geq$ 20% select the set of power units that comprises the larger annual electricity generation (SETsample);

Identify the date when the power units in SETsample started to supply electricity to the grid. None of the power units in SETsample started to supply electricity to the grid more than 10 years ago[35]. Therefore SETsample is used to calculate the build margin and steps (d), (e) and (f) of the tool are ignored.

[35] File 5b table 7

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (8)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in the year *y* (tCO_2/MWh)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power unit *m* in the year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in the year *y* (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent year for which data is available (2008)

The CO_2 emission factor for each power unit is determined per guidance step 4(a) using Option A1.

Step 6: Calculate the combined margin emission factor

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (9)$$

Where:

$EF_{grid,CM,y}$	Combined margin CO_2 emission factor in the year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in the year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in the year *y* (tCO_2/MWh)
w_{OM}	Weighting of operating margin emission factor (%)
w_{BM}	Weighting of build margin emission factor (%)

The default values for weighting w_{OM} and w_{BM} of 0.5 are used as the project is a hydropower plant in the 1st crediting period.

LEAKAGE EMISSIONS

No leakage emissions are included according to ACM0002.

EMISSION REDUCTIONS

$$ER_y = BE_y - PE_y \quad (10)$$

Where:

ER_y	Emission reductions in the year *y* (tCO_2)
BE_y	Baseline emissions in year *y* (tCO_2)
PE_y	Project emissions in year *y* (tCO_2)

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

Data / Parameter:	**$FC_{i,m,y}$**
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plant *m* in the year *y*

Source of data used:	MONRE, 2010 (File 49)
Value applied:	See B.6.3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data years 2006/7/8 used i.e. 3 most recent years prior validation. Once for 1st crediting period determined ex-ante.
Any comment:	Data based on fuel efficiency factor per power plant (fuel usage in relation to net electricity generation) as reported by EVN

Data / Parameter:	$\mathbf{EG_{m,y}}$
Data unit:	MWh
Description:	Net electricity generated by power plant *m* in the project electricity system in the year *y*
Source of data used:	MONRE, 2010 (File 49)
Value applied:	See B.6.3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data years 2006/7/8 used i.e. 3 most recent years prior validation. Once for 1st crediting period determined ex-ante.
Any comment:	Gross electricity generated minus internal power consumption as reported by EVN

Data / Parameter:	$\mathbf{\eta_{m,y}}$
Data unit:	-
Description:	Average net energy conversion efficiency of power unit *m* in the project electricity system in the year *y*
Source of data used:	UNFCCC
Value applied:	Default values provided by Annex 1, Tool to calculate the emission factor for an electricity system
Justification of the choice of data or description of measurement methods and procedures actually applied :	Used for non-EVN power plants with no reported efficiency factor i.e. a small minority of plants. No company specific data available for these plants.
Any comment:	

Data / Parameter:	$\mathbf{NCV_i}$
Data unit:	TJ/Gg
Description:	Net calorific value of fossil fuel type *i*
Source of data used:	MONRE, 2010 (File 49)
Value applied:	Data per power plant

Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$EF_{CO2,i}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type *i*
Source of data used:	IPCC 2006 guidelines, Chapter 1 Vol. 2 table 1.4, lower limit of the uncertainty at a 95% confidence interval
Value applied:	Anthracite Coal: 94.6 Other Bituminous coal: 89.5 Natural gas: 54.3 Fuel Oil: 75.5 Diesel oil: 72.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	Once for 1st crediting period
Any comment:	

Data / Parameter:	**$EF_{grid,CM}$**
Data unit:	tCO_2/MWh
Description:	Combined Margin CO_2 emission factor for grid connected power generation
Source of data used:	See B.6.3. and above sources
Value applied:	0.5764
Justification of the choice of data or description of measurement methods and procedures actually applied :	Once for 1st crediting period As per "Tool to calculate the emission factor for an electricity system"
Any comment:	

Data / Parameter:	**$EF_{grid,OM}$**
Data unit:	tCO_2/MWh
Description:	Operating Margin CO_2 emission factor for grid connected power generation
Source of data used:	See B.6.3. and above sources
Value applied:	0.6465
Justification of the choice of data or	Once for 1st crediting period As per "Tool to calculate the emission factor for an electricity system"

description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$EF_{grid,BM}$**
Data unit:	tCO_2/MWh
Description:	Build Margin CO_2 emission factor for grid connected power generation
Source of data used:	See B.6.3. and above sources
Value applied:	0.5064
Justification of the choice of data or description of measurement methods and procedures actually applied :	Once for 1st crediting period As per "Tool to calculate the emission factor for an electricity system"
Any comment:	

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

Project Emissions

The Power Density PD is calculated based on formula 2.

Data required:
Cap_{PJ}[36]: 90 MW
A_{PJ}[37]: 6.9 km^2

The energy intensity is thus 13.0 W/m^2. According to ACM0002 if the power density is >10W/m^2 the project emissions are 0.

Baseline Emissions

Annex 3 details all calculations. Table 16 resumes all data for the calculation of emission reductions.

Table 16: Calculation of Emission Reductions

Parameter	Value
Operating margin (weighted average years 2006-2008)	0.6465 tCO_2/MWh
Build margin (year 2008)	0.5064 tCO_2/MWh
Combined margin	0.5764 tCO_2/MWh
Annual energy generation to the grid	374,576 MWh

[36] File 6, p.2

[37] File 11, p.2

Annual emission reductions	215,906 tCO_2

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

Year	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
2011 (6 months)	0	107,953	0	107,953
2012	0	215,906	0	215,906
2013	0	215,906	0	215,906
2014	0	215,906	0	215,906
2015	0	215,906	0	215,906
2016	0	215,906	0	215,906
2017	0	215,906	0	215,906
2018 (6 months)	0	107,953	0	107,953
Total (tCO_{2e})	**0**	**1,511,342**	**0**	**1,511,342**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{y,net}$**
Data unit:	MWh
Description:	Electricity supplied by the project activity to the grid, in the year *y*
Source of data to be used:	EVN sales receipt and on-site metering
Value of data applied for the purpose of calculating expected emission reductions in section B.5	374,576
Description of measurement methods and procedures to be applied:	Electricity output will be measured by the 3 phase meter calibrated by the Vietnam's Directorate for Standards and Quality (STAMEQ) and validated by EVN, hourly measurement and monthly recording.
Monitoring frequency	Hourly measurement and monthly recording
QA/QC procedures to be applied:	Check with sales receipt to ensure consistency. The uncertainty level of this data is low. Equipments are calibrated and checked on a regular base.
Any comment:	

Data / Parameter:	**CAP_{PJ}**
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data to be used:	Project site

Value of data applied for the purpose of calculating expected emission reductions in section B.5	90
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards
Monitoring frequency	Yearly
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\mathbf{A_{PJ}}$
Data unit:	km^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6.9
Description of measurement methods and procedures to be applied:	Surface of reservoir will be indirectly measured by the water level. Latter is measured automatically by installed equipment.
Monitoring frequency	Yearly
QA/QC procedures to be applied:	
Any comment:	

TEG is not monitored as according to ACM0002 this parameter is only required for power plants with a power density of the project activity (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2 which is not the case in the project activity.

All the above monitored data will be stored for 2 years after the end of the crediting period.

B.7.2. Description of the monitoring plan:

Bac Ha Hydropower JSC with letter No.04/TĐBH/KT-KH dated 25th January 2005 established a CDM board of Bac Ha hydropower plant for implementing and monitoring the CDM project activities[38]. Staff

[38] File 34

involved in the CDM team include the hydro-power vice-director (team leader), staff of the engineering, economic, planning and human resources department.

Description of the metering system

Total electricity production is measured by electric measuring equipments in the poles of the generators. Net electricity generation of the project will be measured and monitored through the use of on-site metering equipment at the outgoing feeder of Bac Ha hydropower plant. This metering system belongs to EVN and will be calibrated and maintained through EVN. EVN will pay the project owner according to the net production (outgoing minus ingoing electricity) The meter system which will be located in a secure, sealed housing, will meet the standards of EVN and the Vietnamese Quality standards. The project owner installs a 2nd meter for QA purpose only. Readings are based on the EVN meter.

Quality Assurance

The second meter will be used to cross check the primary EVN meter. To check that the data has been recorded correctly, the monthly monitored data will be cross checked with the generation records produced by EVN to pay Bac Ha.

Data Collection and Management

Following principles are applied:

- The electricity supplied by the project to the grid will be automatically monitored by the two meters.
- The data is measured on a hourly basis and monthly reports are generated.
- All records of electricity generation output will be archived in paper form for at least two years after finishing the seven year crediting period.
- Paper invoices are collated by the Project Manager and archived for at least two years beyond the end of the crediting period.

The annual monitoring reports and data quality check will be realized by ecotawa AG through its Vietnamese partner.

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

Completion date: 17/08/2010

The PDD was developed by Dr. Jürg M. Grütter of ecotawa AG. Staff involved in the elaboration of this PDD are also Daniel Wunderlin, ecotawa AG as well as staff of the Vietnamese partner of ecotawa AG.

ecotawa AG is responsible for the baseline determination of the project.

Contact person: Jürg M. Grütter
jgruetter@gmail.com
www.ecotawa.com

ecotawa AG is also project participant as listed in Annex 1.

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:

21/05/2005

Signature of construction contract[39].

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

Minimum 30 years[40].

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:

01/07/2011

C.2.1.2. Length of the first crediting period:

7 years 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

[39] File 18

[40] Generators and transformers according to EB 50 Annex 15; 150,000 hrs for hydro turbines according to EB 50 Annex 15 (equivalent to 35 years at planned operational hours per annum); construction 40 years according to Decision No. 2014/QD-BCN dated 13 June 2007 by the Minister of Industry (File 5)

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Hydropower plants in Vietnam must meet the following environmental requirements:

- Land-law: approved by National Assembly 26/11/2003;
- Environmental protection law: approved by National Assembly 29/11/2005;
- Decree No. 175/CP dated 18/10/1994 of the Government on the Environmental Protection law implementation;
- Decree No.80/2006/NĐ-CP dated 09/06/2006 of the Government providing detailed guidance on the implementation of the Environmental Protection law;
- Circular No. 490/1998/TT-BKHCNMT dated 29/04/1998 of the Ministry of Science, Technology and Environment for guidance of investment project environmental assessment report preparation and evaluation
- Water resources law

The project made an EIA issued in May 2007 (see details chapter D.2)[41].

Decision No. 888/QD-BTNMT of MONRE dated June 11th 2007 gave the approval for the EIA of Bac Ha HPP[42].

The permit for surface water exploitation and usage has not yet been received as this document is only given to the project 6 months prior commissioning.

The project is also validating its conformance with WCD requirements.

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:

An EIA was issued May 2007 and approved by the Ministry of Environment and Nature Resources June 2007. The main environmental impacts of the project, recommendations given and actions taken are listed in table 17.

Table 17: Environmental Impacts, Recommendations and Actions Taken

Potential Environmental Impacts	Recommendations Given by EIA	Actions Taken by Project
Construction and Preparation Period		
Air and noise pollution being basically mud and dust from transportation and construction vehicles, dust from	Covering canvas for all vehicles transporting materials, spray water, vehicles must comply with standards	Implemented; see equipment registration documents, road watering contracts etc[43]

[41] File 35

[42] File 36

concrete mixing	etc.	
Solid waste from worker's camp and construction activities	Waste collection in camps and clearance of vegetation in reservoir area	
Terrain and geomorphology impacts	Compliance with regulations; however no significant impact expected	
Water pollution due to waste from maintenance & cleaning such as mechanical oil, lubricants etc, due to workers camp and due to decaying biomass when filling the reservoir. Change of water flows and water quality.	Divert water through tunnel, comply with regulations, build septic tank at camp and collect oils/lubricants etc.	Contract No.01/2010/QTDK/BHHC-CNX for regular environmental monitoring at Bac Ha HPP between Bac Ha HPP JSC and Green Industry MTV TV MT JSC[44].
Safety issues	Comply with regulations labour and safety	Regulations and safety standards of Bac Ha[45].
Operation Period		
Change of hydro-geographical system, land erosion and sedimentation, change of water quality, create semi-flooder regions along the reservoir, land-use change, inundated biomass, less sand downstream	Regular monitoring, comply with regulations (e.g. discharge rate, forestry)	Contract No.01/2010/QTDK/BHHC-CNX for regular environmental monitoring at Bac Ha HPP between Bac Ha HPP JSC and Green Industry MTV TV MT JSC[46].

Source: Environmental impact and recommendations: See EIA, File 35

SECTION E. Stakeholders' comments

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

Due to the reservoir 66 households with 325 inhabitants are dislocated and 866 households with 4,449 inhabitants are affected[47]. The Decision No. 1156/QD-UBND of the People's Committee of Lao Cai Province dated May 22nd 2007 approved the plan for compensation, support and resettlement of Bac Ha HPP[48]. The Decision No. 38/09/BHHC-HDQT-QD dated February 15th 2009 approved the adjustment to

[43] Files 37 to 40

[44] File 41

[45] Files 42 to 45

[46] File 41

[47] File 13

[48] File 24

the total investment for compensation, support and resettlement[49] and the Decision No 2592/QD-UBND dated September 15th 2009 of the Lao Cai Province People's Committee approved the additional adjustment expenses for compensation, support and resettlement of Bac Ha HPP[50].

The indemnification was determined based on the legal framework of the Government and the Province. The total estimated compensation for the construction of the hydropower plant is 153 billion VND[51] of which compensation paid for land, crops and resettlement is 84 billion VND and compensation for affected households is 45 billion VND. Dislocated people can get:

- People who move to Lang Moi resettlement and Tham Phuc resettlement zone will get new houses with toilets, kitchens, water tanks, animal sheds, discharging ditches etc. Besides, the project owner has also built a water supply system, electric lines as well as a rural road for 2 resettlement zones.
- Farmland: There are 2 farmland areas with 11ha in Tham Phuc hamlet and 25ha in Lang Moi hamlet. The project owner has built an irrigation system from Nam Hu spring to supply water for the farmland and has built a rural road for better access.
- Financial support for livelihood.

Before construction start of the project, PECC1 conducted a sociological study on the affected households with photographs, signatures of household representatives and study conductor and certification by the local authorities as evidences for that study process. Thereafter, Bac Ha HPP JSC coordinated with relevant authorities including the Council on Compensation and Land Clearance and representatives of the local authorities, to build the standard on "Compensation, support and resettlement" so as to be in line with local economic conditions, legal compliance and to be in accordance with government and local regulations. During the compensation and resettlement process, the project owner also made efforts to meet the expectations of the local people.

Interviews with 126 stakeholders were also realized including farmers, local representatives, local officials and workers. The interviews were conducted in June 2010 by a private company. Questions raised included potential positive or negative impacts of the project (on livelihood, air quality, water quality including irrigation, agricultural production), general appraisal of the project, opportunities for local inhabitants, and any other opinions[52] (see chapter E.2. for details).

E.2. Summary of the comments received:

Major impacts of the project identified by stakeholders include:

- Loss of land (88% of all interviewed and resettlement and emigration (13% of all interviewed).
- The impact on water and irrigation is deemed by the majority as regular/no change respectively there is enough water (97%). Only 3% expect that the situation will worsen.

[49] File 46

[50] File 25

[51] File 46, p.3

[52] The full list of all interviewed and a summary of results can be found in File 47

- 54% of interviewed stakeholders consider that the agricultural production will remain the same while 44% expect an improvement. Only 2.5% expect it to worsen.
- In question of air pollution dust is mentioned. Also noise during construction activity appears frequently as complaint.
- 100% of interviewed stakeholders are satisfied with the project. None is against it. Basically stakeholders identify that the project will contribute positively with jobs and socio-economic development (aquaculture, improved local infrastructure, tourism, electricity supply, agricultural production).
- Other issues mentioned is that environmental performance must be monitored, water sources must be protected, reforestation should happen, local workers should be employed, affected people should be compensated, and environmental impacts such as noise or dust during construction should be minimized. Also some stakeholders worded concern over safety measures during plant operation (dam, landslides).

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

The concerns mentioned have been addressed by the company being basically:

- Noise and dust pollution have been mitigated as far as possible based on the recommendation given by the EIA (see former table).
- Compliance with regulations including safety measures.
- Contract has been realized for permanent environmental monitoring through an independent 3rd party[53].
- Agreements with all affected people on compensation plans (see E1).

[53] File 41

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Official Development Assistance in this project and the project will not receive any public funding from Parties included in Annex I.

Annex 3

BASELINE INFORMATION

Table A.1 Fuel consumption, emissions and power generation of fossil plants in the most recent 3 years (2006, 2007, 2008)

Power plants	**Fuel consumption** Coal, oil: kton Gas: mm^3)	**Power generating to the grid** (GWh)	**Emission** (t CO_2)
2006			
Coal thermal power plants	5,645.86	8,989.230	11,823,610
Gas turbines		26,542.978	12,479,578
- Gas turbine using gas	5,743,235.28	18,838.764	12,244,651
- Gas turbine using petroleum oil	70.14	233.582	234,927
- Add-on (steam/heat)	0	7,470.632	0
Diesel thermal power plant	397.65	1,043.991	1,327,593
Diesel power plant using FO	16.60	80.000	51,642
Diesel power plant using DO	6.39	25.000	20,495
Imported power		937.000	0
Total		37,618.119	25,702,918
2007			
Coal thermal power plants	6,386.09	9,836.548	13,272,897
Gas turbines		29,474.918	13,116,063
- Gas turbine using gas	5,910,941.84	20,023.591	12,570,669
- Gas turbine using petroleum oil	163.27	557.880	545,394

- Add-on (steam/heat)	0	8,893.447	0
Diesel thermal power plant	614.06	1,834.409	2,046,368
Diesel power plant using FO	25.15	104.626	79,867
Diesel power plant using DO	9.16	42.000	29,088
Imported power		2,629.000	0
Total		43,921.501	28,544,283
2008			
Coal thermal power plants	6,483.99	10,055.394	13,378,811
Gas turbines		33,857.135	14,716,799
- Gas turbine using gas	6,839,114.84	22,396.231	14,535,266
- Gas turbine using petroleum oil	54.35	183.088	181,533
- Add-on (steam/heat)	0	11,277.816	0
Diesel thermal power plant	534.59	1,481.880	1,784,825
Diesel power plant using FO	22.48	90.465	71,385
Diesel power plant using DO	3.73	15.000	11,879
Imported power		3,220.000	0
Total		48,719.874	29,963,699

Table A.2 Total emission and power generation fossil plants of the most recent 3 years

	2006	**2007**	**2008**	**Total**
Total power generation fossil plants (MWh)	37,618,119	43,921,501	48,719,874	**130,259,494**

Total emission (tCO2)	25,702,918	28,544,283	29,963,699	**84,210,900**

Table A.3 Result of OM emission factor

Year	**Total power generation fossil plants (MWh)**	**Total emission(tCO_2)**	**OM $_{2008}$** (tCO_2/MWh)
	A	B	(∑B/∑A)
2006	37,618,119	25,702,918	
2007	43,921,501	28,544,283	
2008	48,719,874	29,963,699	
Total	**130,259,494**	**84,210,900**	**0.6465**

Table A.4 Calculation of BM emission factor in 2008

Power plant	**COD year**	**Fuel consumption** (Coal, oil: kton Gas: mm^3)		**Power generated to the grid** (MWh)	**Emission** (t CO2)
The set of 5 power plants most recently constructed					
A Vuong	2008	Hydropower		168,103.50	

Tuyen Quang	2008	Hydropower		1,136,112.18	
Dai Ninh	2008	Hydropower		1,145,108.50	
Nhon Trach	2008	Gas	166.38	544,808.60	378,023
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24	1,431,048
		Add-on		2,728,872.00	
Total				**7,829,812.02**	
The set of power plants most recently constructed contributes 20% of total power generation					
A Vuong	2008	Hydropower		168,103.50	
SROC Phu Mieng IDICO	2006	Hydropower		241,556.00	
Se San 3A	2006	Hydropower		394,895.70	
Tuyen Quang	2008	Hydropower		1,136,112.18	
Dai Ninh	2008	Hydropower		1,145,108.50	
Se San 3	2006	Hydropower		1,131,614.00	
Quang Tri	2007	Hydropower		250,804.40	
Uong Bi 2	2007	Coal	281,759	532,000.00	581,018
Na Duong	2005	Coal	532	627,930.00	883,846
Cao Ngan	2007	Coal	526	708,693.00	1,081,146
Formosa	2004	Coal	495	560,295.00	1,291,303
Nhon Trach	2008	Gas	166.38	544,808.60	378,023
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24	1,431,048
		Add-on		2,728,872.00	
Phu My 2.2	2004	Gas	1,159.75	4,141,980.00	2,510,751

Phu My Nitrogen	2006	Gas	56.15	4,716.00	133,868
CAI LAN - VINASHIN	2007	FO	22.48	90,465.01	71,385
Total				**16,514,761.12**	**8,362,386**
Result of BM emission calculation (BM)					
Total emission			8,362,386 (tCO_2)		
Total power generation			16,514,761 (MWh)		
BM_{2008}			**0.5064 tCO_2/MWh)**		

Total electricity output for the Vietnam power grid in 2008 is 74,689,635.97MWh
20% of this output is: 14,937,927 MWh
The 5 most recent plants constitute with 7,829,812 thus less than 20%

Table A.5 Calculation of Combined Margin

A	Estimated operating margin emission rate	tCO2/MWh	**0.6465**
B	Estimated build margin emission rate	tCO2/MWh	**0.5064**
C	Estimated baseline emission rate	tCO2/MWh	**0.5764**

Annex 4

MONITORING INFORMATION

Details see chapter B.7.2.

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