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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Project title: Chau Thon Hydropower Project.
Version 1.9: Prepared for host country approval purpose and validation processes
Completion date: March 3rdh 2009

A.2. Description of the project activity:

Project Entity and Purpose of the Project Activity

The Chau Thon hydropower project is being developed by Son Vu Energy Development Joint Stock Company. The proposed project activity aims to construct and operate a run-of-river hydropower project which is considered as an environmentally friendly solution to growing energy demand. It will be situated in Chau Thon Commune, Que Phong District, Nghe An Province in the centre of Vietnam and is hereafter referred to as "the project activity". The proposed project utilises the Nam Tot stream which is part of a tributary system linking it to the Quang River and eventually to the Hieu River. The project has been significantly delayed since the decision to proceed with the projects as a CDM project owing to severe adverse economic conditions in Vietnam (e.g. inflation rates of over 25%) in 2007- present.

The project will use imported critical items of plant to generate approximately 73,216 MWh/pa of power, leading to estimated emission reductions in the order of 45,636 tCO_2 / pa during the first seven year crediting period. This will offset the combustion of thousands of tonnes of fossil fuels and, in doing so, will help preserve non-renewable resources by promoting the exploitation and use of renewable resources and technologies.

This is particularly important in Vietnam where the share of hydropower and other renewable energy in the country's total generation has fallen year after year for the past five years. Currently, due to shortfalls in the amount of electricity available, Vietnam imports electricity from China, where the grid emission factor is higher than that of Vietnam.

Contribution to Sustainable Development

An analysis of the economic, social and environmental aspects of the project shows that the project meets the host country's sustainable development criteria for a Clean Development Mechanism project. In order to quantify the sustainable development contribution of this project, the project owner has voluntarily agreed to donate 2.5% of the CER revenue from the project towards sustainable development initiatives for the local community.

The project has positive impacts with respect to the environment (offsetting fossil fuel use and lowering greenhouse gas emissions), socially (providing jobs, ensuring a reliable electricity supply and developing infrastructure), technologically (technology, knowledge and skill transfer) and economically (satisfying growing energy demands to allow the country to develop, contributing taxes to local budget and alleviating poverty).

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)	Private Entity: Son Vu Energy Development Joint Stock Company (as the project owner)	No
Switzerland	Private Entity: Bunge Emissions Holdings Sarl	No

Son Vu Energy Development Joint Stock Company: set up developing energy projects and importing products for the energy industry, based in Hanoi, Vietnam.

Bunge Emissions Holdings Sarl: Bunge is an integrated, global agribusiness and food company operating in the farm-to-consumer food chain. With respect to carbon emission reductions, Bunge has been active in this sector through is subsidiary Ecoinvest carbon SA for a number of years. Bunge Emissions Holdings Sarl, one of the subsidiaries that act as a buyer of CERs, VERs and ERUs and as financial partner, has been active for more than one year with expertise in more than thirty projects in more than ten countries across three continents.

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.:

Nghe An Province

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

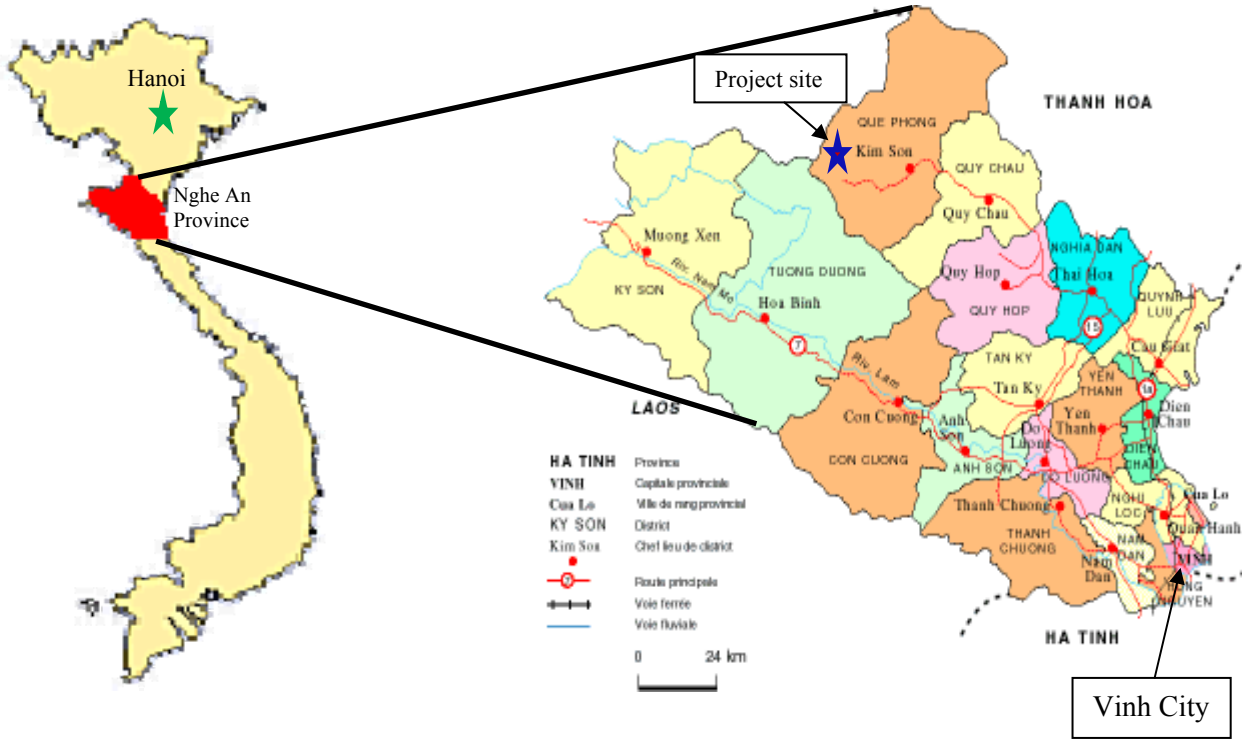
Chau Thon Commune, Que Phong District

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

The proposed project location is Nghe An province in the north of central region of Vietnam, which is one of the poorest areas in Vietnam. It is situated on the Nam Tot stream which is a left grade 1 branch of the Quang River which runs into the Hieu River. The Chau Thon watershed is positioned in a high mountainous area with an area of 98.6 km^2. The terrain of the location has created a net head of approximately 413.5 m^3 to produce electricity. The project site is 15km from Que Phong town and 150 km from Vinh city.

The co-ordinates of the site are latitude of 19°36'25"N to 19°34'50"N and longitude of 104° 47'10"E to 104°47'45"E[5]. Figure A.2 shows the location of the project.

Figure A.2 Project Location



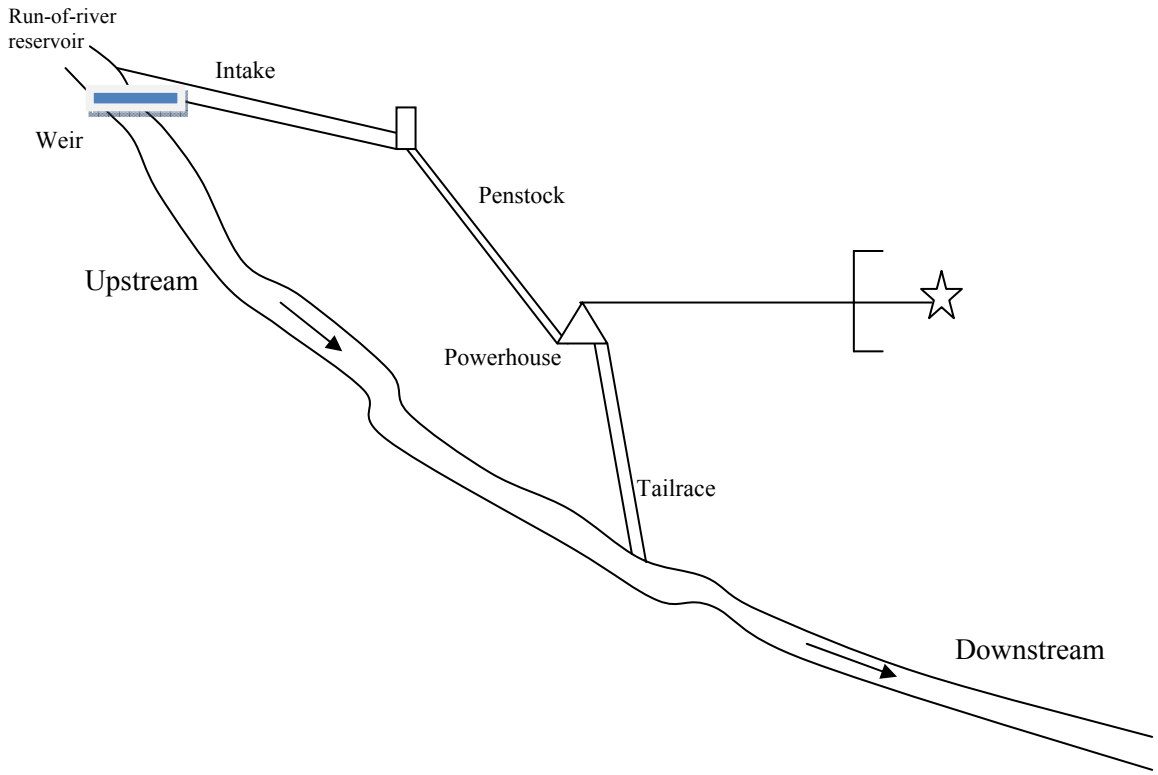
A.4.2. Category(ies) of project activity:

Sectoral Scope 1: Energy industries (renewable/non renewable sources)

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

The proposed project is a run-of-river hydropower plant with a small run-of-river reservoir and consists of a weir, an intake, a forebay or pressure intake, a penstock, a powerhouse (containing turbines and generators) and a tailrace as shown in Fig. A.3. The installed capacity of the project is 18 MW with total expected annual net generated electricity of 73,216 MWh per annum. The specific items of plant employed by the project are expressed in Table A.2. The main items of equipment such as turbines, generators, governors shall be imported from China. This will contribute to the transfer of skills and technology to Vietnam. The electricity generated by the project will be delivered to the Vietnam national grid initially via a new 35 kV transmission line from Chau Thon hydropower plant and eventually through a series of transmission lines and transformers to the Vietnamese national electricity grid (full details are provided in Annex 4).

Fig. A.3. A schematic representation of the proposed project activity



The technology of the project is detailed in the Table A.2. This technology is considered to be relatively environmentally safe as the plant is a run-of-river project with a small run-of-river reservoir. The plant can therefore be constructed and operated in a manner which does not involve significant land clearing or development, as in the case of accumulation reservoir types of projects. This is in addition to the fact that power is generated by a renewable resource and resulting in zero emissions.
\Table A.2. The main technologies used in the project, imported from China

	Items	Specification
Turbines	Quantity	3
	Capacity	6211,18 kW
	Type	Pelton, 2-jets
	Model	A475T-WJ-115/$_{2 X 11}$
	Rated speed	750 rpm
	Efficiency	0,885
Generators	Quantity	3
	Capacity	6,000 kW
	Type	Three- phase synchronization, horizontal axis
	Cosα	0.8
	Rated speed	750 rpm
	Runaway speed	1250 rpm
	Rated Efficiency	96.60%

Governors	Quantity	3
	Type	Electric-Hydraulic
	Oil pressure	4 MPa
	Adjusted frequency	47.5-52.5 Hz

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

The annual emission reductions of the proposed project are estimated to be 45,636 tCO_2e as shown in Table A.3. The project will employ a renewable crediting period and the total emission reductions are estimated to be 319,452 tCO_2e for the first seven year crediting period.

Table A. 3. The annual emission reductions of the proposed project for the first crediting period

Years	Estimation of annual emission reductions in tonnes of CO_2e
January 1st 2010 – December 31st 2010	45,636
January 1st 2011 – December 31st 2011	45,636
January 1st 2012 – December 31st 2012	45,636
January 1st 2013 – December 31st 2013	45,636
January 1st 2014 – December 31st 2014	45,636
January 1st 2015 – December 31st 2015	45,636
January 1st 2016 – December 31st 2016	45,636
Total estimated reductions (tCO_2e)	**319,452**
Total number of crediting years	**7**
Annual average of the estimated reductions over the crediting period	**45,636**

A.4.5. Public funding of the project activity:

There is no public funding for the proposed 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 project activity:

Methodology: ACM0002, Consolidated Methodology for Grid Connected Electricity Generation from Renewable Sources, Version 9

As the project's total installed capacity is 18MW (above the 15MW CDM small / large scale project threshold) and employs a renewable source of energy (hydropower) to be exported to a national grid

system, the proposed project should be considered under the above methodology and the accompanying tools:

- Tool for the demonstration and assessment of additionality (Version 5.2)
- Tool to calculate the emission factor of an electricity system (Version 01.1)

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

	Applicability Criteria	Project Activity
1	The project activity is the installation or modification/retrofit 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 activity involves the installation of a new hydropower project with a small run-of-river reservoir.
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 of ACM0002, is greater than 4 W/m^2.	The new reservoir associated with this project has a power density of 66.7W/m^2 as defined in ACM0002
3	The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.	This is the case, please refer to section B.4.

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

In the proposed project activity, the generated electricity of the project will be delivered to the Vietnam national grid system. As per the guidance set out in ACM0002, the project boundary is therefore set at the extent of the Vietnam national grid system which is mainly comprised of a range of thermal, gas, diesel oil and hydropower plants (please see section B.4.). This is represented diagrammatically in Fig. B.1.

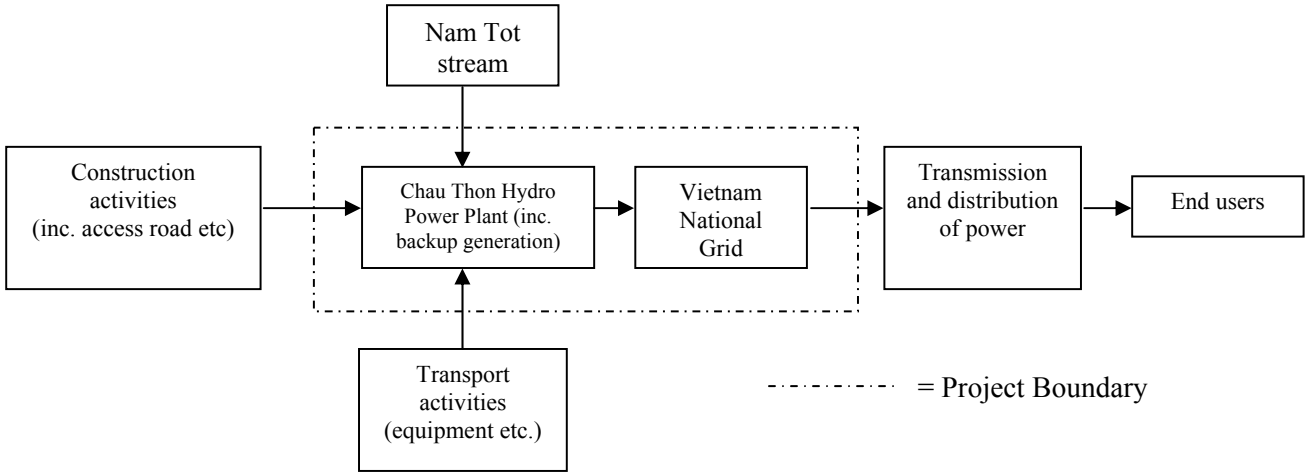


Figure B.1. The project boundary

As per ACM0002/Ver 09, the following sources and gases are included the project boundary

Table B.1. Source and gases in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation of thermal power plants connected to the Vietnam national grid	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	
Project activities	Run-of-river hydropower plant with the power density of a run-of-river reservoir of 66.7 W/m^2	CO_2	No	Excluded as per the guidance in the ACM0002 (Version 09)
		CH_4	No	
		N_2O	No	

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

As per the guidance of ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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 (CM) calculations described in the "Tool to Calculate the Emission Factor for an Electricity System".

The state-owned company Electricity of Vietnam (EVN) dominates power production, transmission, and sales in Vietnam. One of the key assumptions made in determining the baseline is to treat the whole grid system as one entity. The grid system is not divided into provincial sub-groups (as in China for example), the only distinctions made by the EVN as to categorising power stations are by type (coal, gas, hydropower etc.), geographical location (North, Central and South) and ownership (state, independent power producer, "build-operate-transfer"). Over the period 2001-2005, total capacity in power sources has increased from 6,192 MW in the year 2000, to 11,298 MW in 2005 and the greatest contributor to the total amount of electricity generated are fossil fuel fired plants.[1]

[1] Source: Electricity of Vietnam

Data Used to Determine Baseline Emissions

Table B.2 shows the parameters required to calculate the emission factor of each power plant that serves the national grid system.

Table B.2. Data used to determine baseline emissions

Parameter	Detail	Source
Amount of fossil fuel consumed	Amount of fossil fuel consumed by the power plant in the year	EVN dispatch data
Net calorific value of fuel consumed	Energy content of the fuel used by the power plant	IPCC data
Net electricity generated and delivered to the grid	Energy generated minus electricity consumed by the power plant itself	EVN dispatch data
Emission factor of fuel consumed	The amount of carbon dioxide released as a result of	IPCC data
Date power plant was built	The power plant is considered to be built when it started to supply electricity to the grid	National Power Development Master Plan in the period 2006-15 and Outlook to 2015.

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):

With the implementation of the project activity, the emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity is *additional* and would have not occurred anyway due to the barriers identified below.

In compliance with the "Tool for the Demonstration and Assessment of Additionality", the investment analysis (step 2) has been selected as an appropriate method to demonstrate additionality:

Step 1. Identification of Alternatives to the Project Activity Consistent with Current Laws and Regulations

Sub-step 1a: Define Alternatives to the Project Activity

The following three scenarios are presented for consideration with respect to likelihood and credibility:

a. The proposed project activity undertaken without being registered as a CDM project activity;
b. Construction of a fossil-fuel fired power plant or any other energy renewable power plants with equivalent amount of annual electricity generation;
c. Continuation of the current situation (no project activity or other alternatives undertaken)

An analysis of the three options identified above to identify the most realistic and credible alternative is presented below:

- Alternative (a) is not a credible nor realistic alternative as, according to the investment analysis presented in section B.5 below, without the assistance of the CDM, the project is not a financially attractive for investment.
- Alternative (b) is also not realistic nor credible because, with respect to energy, the Son Vu Energy Development J.S.C only has experience in the field of hydropower project development and therefore a coal fired power station or wind farm is not an option.
- Alternative (c), where there is a continuation of the current situation (no project activity or other alternatives undertaken) and electricity is provided from the Vietnam national grid, is a credible and realistic scenario (hence it is the baseline scenario).

Sub-step 1.b: Consistency with Mandatory Laws and Regulations

The only identified alternative to the project proceeding with carbon revenue from the CDM is alternative (c) and this in compliance with all Vietnam legal and regulatory requirements.

Step 2: Investment Analysis

Sub-step 2a: Determine Appropriate Analysis Method

This is a large scale project activity. Hence, additionality of the project has to be demonstrated as per the Additionality Tool Ver. 05. The tool for the demonstration and assessment of additionality provides three methods of analysis: simple cost analysis (option I), investment comparison analysis (option II) and benchmark analysis (option III).

The simple cost analysis (option I) cannot be employed because the proposed project produces economic benefits other than CDM related income (through the sale of electricity). Therefore, the project developer has the choice of using either Option II - "investment comparison analysis" or Option III - benchmark analysis. Of the alternatives, the project developer has chosen option III- benchmark analysis to demonstrate the additionality of the proposed project activity.

Sub-step 2b: Option III. Apply Benchmark Analysis

Additionality Tool Ver. 05 stipulates that the project developer should identify the financial/ economic indicator, such as IRR, most suitable for the project type and decision context. As prescribed by the Additionality Tool itself, the project developer has chosen project IRR to demonstrate the additionality.

The project IRR needs to be compared with a benchmark to prove the financial unattractiveness of the project. 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" Besides, the 'Guidance on the Assessment of Investment Analysis' issued by EB in its 41st meeting requires that "*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, when the Additionality Tool and Guidance are read together, the selected benchmark should satisfy three conditions:

- It should be Government/official approved;
- It should be used for investment decisions; and
- It should be publicly available data source so that DOE can validate.

Keeping the above requirements in view, the project developer has selected the commercial lending rate in Vietnam at the time the decision was made to proceed with the project. At the time of decision, the State Bank of Vietnam's base rate was 8.25%[2]. Due to the civil code in Vietnam, the commercial lending rate is regulated such that commercial banks cannot charge a rate of interest more than 1.5 times the prime rate[3]. As such, the project proponent could have expected to pay an interest rate of up to 12.38%. Thus, in a conservative manner bearing in mind that inflation was rising rapidly and interest rates were set to follow, the project owner chose a benchmark rate of return of 12.38%. This benchmark satisfies all the three conditions listed above:

- The lending rate of commercial banks is based on the lending rate of the State Bank of Vietnam and hence it is *official rate*;
- The benchmark is *used* by commercial banks *to take a financing decision* in as much as a project which cannot service the interest does not merit consideration by bank; and
- The benchmark is *publicly available* data source and *verifiable by DOE*.

The benchmark of 12.38% chosen, therefore, fulfils all the criteria laid down by the Additionality Tool[4] and is considered conservative. The project developer has selected this rate as the benchmark as this covers the cost of the loan and also provides a return on equity (which is much riskier than term loan). The inherent conservatism of the benchmark can be substantiated by the publication brought out by the International Monetary Fund (IMF). In its publication "Vietnam – Statistical Appendix", the annual interest rate for medium term loan has been stated as 13.7%[5] (computed by compounding applicable monthly interest rates over relevant twelvemonth period.

Sub-step 2c: Calculation and Comparison of Financial Indicators

The following input parameters were considered in making the projected income statement and IRR computation:

Table B.3: Key Input Parameters

[2] State Bank of

[3] Vietnam Civil Code, Article 476.

[4] And also the *Guidance on the Assessment of Investment Analysis*, Point No.11 (page No.3)

[6] This IMF report can be accessed at http://www.imf.org/external/pubs/ft/scr/2007/cr07386.pdf

Parameters	Value	Basis
Installed capacity (MW)	18	Feasibility Report
Plant load factor (%)	47.38%	Feasibility Report
Annual power supplied to the grid (MWh)	73,216	Computed
Auxiliary consumption (as percent of generation)	2%	General norm, transmission and distribution losses
Total Investment (million VND)	365,857,199	Feasibility Report
Loan: equity ratio	70:30	Feasibility Report
Power tariff (Dong/ kWh)	680.4	Feasibility Report
O&M cost (as percent of project cost)	1%	EVN regulations 2014/QD-BCN
Escalation in O&M cost (per annum)	3%	Estimate
Insurance (as percent of project cost)	0.25	Estimate
Interest rate on term loan – in VND	12%	Feasibility Report
– in Foreign Currency	7%	Feasibility Report
Loan repayment period (years)	10	Feasibility Report
Initial moratorium period (years)	1	Assumed and common practice for such loans in Vietnam
Depreciation – Equipment	10%	Present practice in Vietnam and Feasibility Report
-Civil works	5%	Present practice in Vietnam and Feasibility Report
Natural Resource Tax (as percent of revenue)	2%	Ordinance on Natural Resource Tax
Enterprise Income Tax	25%	Law No 14/2008/QH12 dt 03/6/2008 and Decree No. 24/2007/ND-CP dt. 14/2/2007
Life of the project (years)	30	Feasibility Report

Investment in the construction of electric power plants falls under List A domains and lines of business and hence is eligible for investment preferences as per the Decree No. 24/2007/ND-CP dated 14th February 2007. Moreover, the project activity is located in List C of geographical area with special economic difficulties and hence is eligible for investment preferences by the said Decree. The line of activity and the location of the project, therefore entitles it to certain tax concessions, which have been duly accounted for in computation of tax. Moreover, it has been ensured that all the expenditures are allowable as charge on the profit and loss account as per the Decree.

The income statement of the project and the project IRR has been computed based on the above input parameters. In computing the project IRR, profit after tax, depreciation, interest on term loan and salvage value have been taken as cash inflow and the entire project cost as cash outflow as suggested by the Guidance on the Assessment of Investment Analysis. As the IRR has been computed for a period of 30 years and the entire assets are fully depreciated[6], the question of salvage value does not arise. Since a refurbishing cost has been provided in the 16th year to ensure the plant and equipment deliver the expected PLF despite the high wear and tear, salvage value has been taken at 5% of the cost of the project in the terminal year. Based on the above, the project IRR works out to 9.85 % as against the benchmark

[6] Including the additional investment provided in the 16 the year as permitted by the Guidance on the Assessment of Investment Analysis (item No.1)

return of 12%. Table B.4 presents the result of the IRR analysis in comparison with the bench mark identified in sub-step 2b.

Table B.4: Comparison of IRR with the benchmark rate of return

	Project IRR	Benchmark
Values	9.85%	12.38%

The IRR estimate is quite conservative in the sense that the project cost does not include interest during construction or any of the administrative and operational expenses during construction. Likewise, the operating statement is also conservative as the escalation in O&M expenses has been taken only at 3% as against the inflation rate of over 25% and administrative salaries have not been provided. If provisions are made for this, IRR will come down.

Sub-step 2d: Sensitivity Analysis

The robustness of the conclusion drawn above has been tested by subjecting critical assumptions to reasonable variations. Guidance on the Assessment of Investment Analysis defines critical assumptions as those which constitute more than 20% of total project costs or total project revenue and reasonable variation has been defined as a range of +10% and - 10% (item No 16 and 17 of the Guidance). Three factors have been identified as sensitive, viz., project cost, PLF and O&M cost. Though O&M cost does not account for 20% of total cost (total operating cost), it has been considered as interest on term loan and depreciation are not subject to variations as they are determined by project cost and loan documentation. Likewise, both civil works and equipment cost account for more than 20% of the total cost. Though non-tangible costs account for less than 20%, as they are eventually apportioned to tangible fixed assets, entire project cost has been subjected to reasonable variation as. The impact of a 'reasonable variation' in these three parameters on the project IRR have been worked out and the results are as follows:

Table B5: Sensitivity Analysis

Project IRR	-10%	0	10%
PLF	8.39%	9.85%	11.11%
Project cost	11.36%	9.85%	8.54%
O&M cost	9.98%	9.85%	9.73%
Benchmark	12.38%		

It could be seen from the above that even under the most optimistic conditions, the project IRR will not cross the benchmark. The financial unattractiveness of the project is thus evident. Having said that, it needs to be mentioned that the PLF is based on the hydrological study and the most optimistic scenario has been considered while preparing the income statement. Since it is dependent upon climatic conditions, higher PLF is a very remote possibility. O&M costs is not a very major assumption at all and the project is absolutely insensitive to the change in the O&M cost as could be seen that project IRR goes up by only 13 basis points when the O&M cost is brought down by 10%.

Reduction in project cost is also equally highly unlikely as the country hits the highest inflation within a decade. Though the inflation rate has touched 15.7% in February 2008[7] and still had gone up further to 25.2% in May 2008. In the above background, the possibility of any reduction in project cost is highly unlikely. In fact, the costs associated with the project have risen significantly since the feasibility study whilst the power tariff will be locked in the power purchase agreement (PPA). In the above background, the most plausible scenario is only a reduction in the PLF and increase in project cost and not the other way round. Such an occurrence will undoubtedly worsen the project's IRR further and gives greater need for assistance from the CDM.

The project, therefore is not a business-as-usual scenario and hence additional. The CDM benefits will enable the project to improve its return and become viable, as evident from the fact that with CDM benefits, the project will earn a return of 13.61 %. It is in the above background, the CDM registration is requested.

Step 3: Barrier Analysis

Sub-step 3a: Identify Barriers That Would Prevent the Implementation of the Proposed CDM Project Activity

As per the Additionality Tool, the project developer can choose either investment analysis or barrier analysis to demonstrate the additionality. The foregoing paragraphs have already established the additionality of the project based on investment analysis. However, since the project faces a few barriers also, which cannot be succinctly brought out by the investment analysis, the project developer has chosen to highlight some of the non-investment barriers faced by the project activity as well. The Additionality Tool lists out the following four barriers of which at least there should be one barrier preventing the implementation of the proposed project activity without CDM benefits:

a) Investment barrier
b) Technological barrier
c) Barrier due to prevailing practice and
d) Other barriers

Of the above, the project faces an instance of each barrier.

Technological barrier: The project suffers from non availability of skilled and/or trained labour force to operate the plant, lack of infrastructure and risk of technological failure. As mentioned earlier, the project is located in Category 'C' area which has been classified as geographical area with *special economic difficulties*. The nearest habitat is far from the site, therefore the location and non-availability of social infrastructure near the project location renders the project susceptible to the barrier of non-availability of skilled and /or trained labour force to operate the plant.

The project area suffers from some disadvantages of infrastructure. That apart, the project participants will be required to spend approximately VND 8 billion to construct access roads to the project site. Moreover, the construction of the project is only executed during the dry season from November of the previous year to April of the next year. Whilst the construction of road no doubt brings benefits to the

[7] http://www.iht.com/articles/ap/2008/02/28/business/AS-FIN-ECO-Vietnam-Inflation.php, downloaded on August. 15, 2008

location in terms of improved infrastructure, the additional cost does negatively impact the profitability of the project.

The project is at risk of technological failure. As the feasibility study concludes, there are some big faults of which impact on the run-of-river reservoir's bed and weir. One more fault which should be paid attention is Fault III-2 running through the powerhouse's area. And its consequence is a creation of a high slope by landslides. In addition, landslide phenomena often occur in deluvial deposits and extremely weathered areas. At many places in the area of reservoir, penstock and powerhouse, due to high slope and thick weathered layers so that it is easy to occur local landslides. Moreover, the area of the project also belongs to an earthquake's area with intensity maximum of 7 following the MSK-64 scale.

Barrier Due To Prevailing Practice: The clear majority of hydro power plants are developed by the State in the form of state owned IPPs, EVN ownership or by the state taking a shareholding in the project (76% of projects). Of the plants remaining, there are very few that would cross the large scale threshold of 15MW generation capacity, as in the case of Chau Thon (only 21% of projects). This is discussed further in the common practice analysis below.

Other Barriers: Policy: Private investment has only been possible in Vietnam relatively recently and EVN does not have policies in place to promote the development of small scale hydropower plants, e.g. through preferential tariffs. Neither are there any preferential policies for projects which are located in remote areas or do not employ reservoirs. There is however a policy in place to promote the use of accumulation reservoir projects (Ministry of Industry issued Decision No. 3837/QD-BCN on 22/11/2005) but whilst they may be able to generate electricity on a larger scale, their development is more often than not associated with deforestation, resettlement and flooding. Also, the development of small scale hydropower projects located in areas such as those where the proposed project is planned is discouraged, "some works are located in the areas difficult to exploit and far from the power consumption center so they will not be developed in the short-term period" (EVN 2006). Further, due to the state owned EVN's monopoly position, the negotiation of a power purchase agreement is difficult for the independent project developer, where there is no State involvement in the project (it is still common for the state to take a shareholding position) as the market is far from transparent.

Further, the financing and construction phase of the proposed project have taken place during the period of the high inflation rate Vietnam has experienced since 1996. The rate of inflation recorded in /Vietnam was as high as 25% in May 2007. High inflation will affect the construction costs adversely as domestic material and transportation costs are bound to rise. The CDM revenue would surely help in absorbing a part of this unforeseen additional cost burden.

Sub-step 3b: Show That the Identified Barriers Would Not Prevent the Implementation of Atleast One of the Alternatives (Except the Proposed Project Activity).

None of these barriers would apply to State owned thermal power projects and hydropower power projects as these projects are invariably located in regions with well developed infrastructure and human habitation. These projects also have Government backing. In the above background, registration of the project as a CDM activity will enable the project proponent to overcome the barriers, as CER revenue would compensate the loss likely to be incurred by the project proponent in case the risks become reality.

Setting up of hydro power projects for this size and that too in the private sector is not a common practice in Vietnam. Most of the hydro power plants are owned by the State or benefit from State involvement at some level, most important in a country such as Vietnam where contacts and government connections are key. The following table provides details of hydro power plants presently in operation in Vietnam[8], those that have permission granted to build power plants from 2006-2008[9] and those that fall into the build own operate (BOO) or build operate transfer (BOT) category of projects[10]:

Table B.6: Hydro Power Plants and Planned Hydropower Plants for 2005-8 in Vietnam, ordered by size

No.	Power Station , Location	Size (MW)	Company	Remarks
1	Son La, son La	1200	EVN	EVN
2	Yali, Gia Lai	720	EVN	EVN
3	Se San 4, Gia Lai	330	EVN	EVN
4	Thac Mo, Binh Phuoc	300	EVN	EVN
5	Da Nhim-1, Ninh Thuan	160	EVN	EVN
6	Dak My 4, Quang Nam	150	IDICO	State owned IPP
7	Nam Chien, Son La	130	Song (River) Da Constrction Co.	State owned IPP
8	Se San 3A, Gia Lai- Kon Tum	100	Song (River) Da Constrction Co.	State owned IPP
9	A-Dak Rinh, Quang Ngai	100	LICOGI	State owned IPP
10	A- Nale, Lao Cai	85	LICOGI	State owned IPP
11	Can Don, Binh Phuoc	72	Song (River) Da Constrction Co.	State owned IPP
12	A- Dak Rtih	72	No.1 Construction Corp	State owned IPP
13	Chu Linh Coc San, Lao Cai	70	VINACONEX	State owned IPP
14	Quang Tri	70	EVN	EVN
15	A-Eakrong Hnang, Phu Yen, Dak Lak	65	PC 3	EVN
16	Van Chan	57	Van Chan JSC	Assumed private
17	Srok Phu Mieng, Binh Phuoc	51	IDICO	State owned IPP
18	A-Song Con 2, Quang Nam	46	COSEVCO	State owned IPP
19	Thai An, Ha Giang	44	Bac Kan PPC	EVN
20	La Ngau, Binh Thuan	38	CIENCO 5	State owned IPP
21	Ngoi Phat, Lao Cai	36	VINACONEX	State owned IPP
22	Da Dang 2, Lam Dong	36	PC 2	EVN

[8] http://www.industcards.com/hydro-vietnam.htm, downloaded on August 14, 2008

[9] EVN Masterplan for Electricity production 2005-2015

[10] Overview of Policy Instruments for the Promotion of Renewable Energy and Energy Efficiency in Vietnam, 2005: http://www.serd.ait.ac.th/cogen/62/reports/countries/vietnam.pdf

23	Ngoi Bo, Lao Cai	34	VINACONEX	State owned IPP
24	Binh Dien	34	Binh Dien Hydropower JSC	Large private company
25	Bac Binh, Binh Thuan	33	Vietnam Power Development JSC.	Main shareholders are state owned companies
26	Huong Son, Ha Tinh	30	COMA	State owned IPP
27	Song Bac, Ha Giang	30	Vietnam Power Development JSC.	Main shareholders are state owned companies
28	Dakre, Kon Tum	28	CIENCO 5	State owned IPP
29	Eak Rong Rou, Khanh Hoa	28	No information	Assumed private
30	Eakrong Rou	28	Bitexco Corporation	One of the main shareholders is Song Da Corporation (state owned).
31	Bac Ha, Lao Cai	25	Vietnam Power Development JSC.	Main shareholders are state owned companies
32	Bao Loc, Lam Dong	24	LILAMA+ No. 1 Construction Corp.	State owned IPP
33	Da Dang- Dach Mo, Lam Dong	22	CIENCO 5	State owned IPP
34	Song Ong, Ninh Thuan	22	COSEVCO	State owned IPP
35	Dasrong, Gia Lai	20	No information	Assumed private
36	Ban Coc, Nghe An	18	Hanoi Construction Corp.	State owned IPP
37	Nhan Hac, Nghe An	17.5	Hanoi Construction Corp.	State owned IPP
38	An Diem 2, Quang Nam	15	CIENCO 5	State owned IPP
39	H'Mun, Gia Lai	15	PC3+ Gia Lai PC	EVN
40	Dak Pone, Kon Tum	15	PC 3	EVN
41	Minh Luong, Lao Cai	15	Minh Luong Hydropower Co.	Assumed private
42	Bac Na, Lao Cai	15	Vietnam Power Development JSC.	Main shareholders are state owned companies
43	Dasiat, Lam Dong	14	PC 2	EVN
44	H'Chan, Gia Lai	12	PC3+ Gia Lai PC	EVN
45	Nam Mu, Ha Giang	11	Song (River) Da Constrction Co.	State owned IPP
46	Krong Ma, Dak Lak	11	Song (River) Da Constrction Co.	State owned IPP
47	Dak Di 4, Quang Nam	11	No information	Assumed private
48	Suoi Sap, Son La	10	No information	Assumed private
49	Na Loi, Lai Chau	9.3	Song (River) Da Constrction Co.	State owned IPP
50	Ry Ninh 2, Gia Lai	8.5	Song (River) Da Constrction Co.	State owned IPP
51	Khe Dien, Quang Nam	8.5	PC 3	EVN
52	Da Khai, Lam Dong	8	CIENCO 4	State owned IPP

53	Dak Pring, Quang Nam	7.5	No information	Assumed private
54	Nam Chim, Son La	7	No information	Assumed private
55	Van Minh, Lam Dong	6.5	PC 2	EVN
56	Dong Chum 1&2, Hoa Binh	6.5	No information	Assumed private
57	Dai Nga, Dong Nai	6.4	No information	Assumed private
58	Thac Trang, Lai Chau	6	Song (River) Da Constrction Co.	State owned IPP
59	Nam An, Ha Giang	6	Song (River) Da Constrction Co.	State owned IPP
60	Thac Dau Dang, Bac Kan	6	Bac Kan PPC	EVN
61	Ha Nang, Quang Ngai	6	No information	Assumed private
62	Dakrosa, Kon Tum	5.6	COSEVCO	State owned IPP
63	Dan Sach, Bin Thuan	5.5	CIENCO 5	State owned IPP
64	EaWy, Dak Lak	5	PC 3	EVN
65	Da Den, Phu Yen	4.8	CIENCO 5	State owned IPP
66	Song Cho 1, Khanh Hoa	4.8	No information	Assumed private
67	Song Cho 2, Khanh Hoa	4.6	No information	Assumed private
68	Cha Val, Quang Nam	4.5	No information	Assumed private
69	Song Nam, Da Nang	4.2	No information	Assumed private
70	Krong Hin, Dak Lak	4	Me Kong Construction Co.,	Large private company
71	Sar Deung, Lam Dong	4	No information	Assumed private
72	Ta Niet, Son La	3.5	Ta Niet Hydropower Co.	Assumed private
73	Sao Va, Nghe An	3	Hanoi Construction Corp.	State owned IPP
74	Thach Nham, Quang Ngai	3	PC 3	EVN
75	DakAKoi, Kon Tum	3	PC 3	EVN
76	Ia Dang, Gia Lai	1.6	PC3	EVN
77	Nam Dong III&IV, Yen Bai	No info	PC 1	EVN
78	Ho Lo, Ha Tinh	No info	PC 1	EVN

It can be seen from the above that:

- The clear majority of hydro power plants are developed by the State in the form of state owned IPPs, EVN ownership or by the state taking a shareholding in the power producer (76% of projects listed).
- Of the plants remaining, there are few that would cross the CDM large scale / small scale threshold of 15MW generation capacity as Chau Thon does (only 21% of projects).

Hence, construction of hydropower plants of the size of Chau Thon by private corporations is not a common practice in Vietnam.

It should be noted that in the interest of conservatism, for those plants for which no information could be publicly found (the market is not transparent), it has been assumed that there is private ownership. So, in fact, the figures above could go further to demonstrate that the Chau Thon project is not common practice.

Further, the companies that have been identified as private investors have been found to be large corporations. Son Vu Energy Development Joint Stock Company, the developer of the Chau Thon project is made up from individuals and so resources and capital might not be mobilised so easily.

It is not only that the State Utility has monopolized all the large power plants; it is proposing to enter into small scale hydro power projects as well. A news report in Vietnam Business Finance reveals that "the State-owned Electricity of Vietnam Group (EVN) plans to build 37 small hydropower plants with the total investment of VND3.1 trillion (US$193.75 million) in the Vietnam-China border by 2010"[11]

The fact that setting up of hydro power plants such as Chau Thon by the private sector is not a common practice places the project in a disadvantageous situation vis-à-vis its counterpart, viz., the State Utility – EVN. The involvement of state owned companies in a country like Vietnam helps the project significantly, as in the power purchase agreement, permit application and People's Committee approval processes they can use their Government contacts. However, in the case of Son Vu Energy Development J.S.C, the project developer, there is no state involvement and its shareholders are individuals and not even organisations. Besides, by virtue of the fact that the State projects are large in size as revealed in the above table, the economies of scale work in favour of the projects and render them more profitable. This renders the investment safer. The Chau Thon hydropower plant project is located in a very remote part of one of the poorest provinces in Vietnam and employs a relatively small run-of-river reservoir. Hence, the project has to confront more barriers than even a similar sized project if it is set up by the State Utility. The CDM registration will therefore enable the Chau Thon hydropower plant to overcome the barriers and contribute its mite to the global emission reduction effort.

Perhaps most significantly however, the projects detailed above have not been subject to the relatively recent surge in price inflation that Vietnam has witnessed since mid-late 2007. In addition to price inflation, interest rates have risen sharply in a bid to curb rising costs and this has led to a large number of hydropower plants' development being stopped due to unfavourable economic conditions. The CDM will enable the Chau Thon hydropower plant to be developed despite this, and ensure emission reductions can take place.

Prior Consideration of the CDM

The CDM benefit was identified by the Board of Directors of the Chau Thon hydropower plant project as imperative to make the project financially attractive. A resolution to this effect was passed by the Board of Directors on 3rd April 2008, a copy of which has been furnished to the DOE. After the Board accorded approval, a contact was signed with CDM consultant on 30th August 2008. Correspondence and contracts relating to this have also been furnished to the DOE. The project is expected to start with the Project Proponent signing the equipment contract on 1st June 2009. It could be seen from the above that the PP had taken simultaneous action to secure CDM status with the implementation of the project. Therefore, the project activity fulfils both the conditions stipulated by EB vide annex 46 in its 41st Meeting.

[11]3 http://www.vnbusinessnews.com/2008/06/evn-to-build-37-small-hydropower-plants.html . Downloaded 14 August 2008.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

In order to calculate the baseline, project and leakage emissions and hence emission reductions, methodology ACM0002 is used in conjunction with the "Tool to calculate the emission factor for an electricity system (Version 01.1)" including the following steps:

1. Calculation of baseline emissions;
2. Calculation of project emissions;
3. Calculating leakage emissions;
4. Calculating emission reductions.

1. Baseline Emissions

Step 1: Identify the Relevant Electric Power System

As per section B.4., the identified business as usual scenario is the continued generation of power by the Vietnamese national grid system, and baseline emissions are those produced as a result of this. Therefore, the Vietnam national grid is identified as the relevant electric power system.

Step 2: Select an Operating Margin (OM) Method

In this case, the Simple Operating Margin has been calculated. In order to use the Operating Margin, assumption has been made with respect to "low cost" and "must run" resources. These are defined as "as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants."

The state owned EVN defines only hydropower as "low cost" and does not make any reference to "must run" power stations in its documentation. As the contribution of hydropower to the grid's supply capacity is well below 50%, it is safe to assume that "low cost" and "must run" power stations do not make up more than 50% of the grid's input (please refer to table B5). Therefore the "Simple Operating Margin" can be calculated for the purpose of deriving the grid emission factor as per Step 2 of the tool to calculate emission factor from an electricity system.[1]

Table B.5. Contribution of low cost and "must run" sources to overall power generation in Vietnam[12]

Year	2003	2004	2005	2006	2007	Average
Percentage share of low cost and "must run" power stations	46.5	32.0	27.5	30.3	31.5	33.5

The emission factor using the Simple Operating method has been calculated using a three year generation-weighted average, based on the most recent data available at the time of submission of the

[12] EVN data and interview with EVN generation expert, attended by the DOE

CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period. The years used are therefore 2005-07 inclusive.

Step 3: Calculate the Operating Margin Emission Factor According to the Selected Method

In the case of Vietnam, some information regarding the output of the state owned EVN is private and confidential and / or unavailable publicly. As such, Option B under Step 3 of the tool to calculate grid emissions is employed. Here the Simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (1)$$

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 year *y* (tCO_2/MWh)
m = All power units serving the grid in year *y* except low cost / must run power 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 (*ex ante* option).

If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows (Option B1):

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad (2)$$

Where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in 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 (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)

$EF_{CO2,I,y}$ = CO_2 emission factor of fossil fuel type *i* in 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 units

I = All fossil fuel types combusted in power unit *m* in year *y*

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 (*ex ante* option) or the applicable year during monitoring (*ex post* option), following the guidance on data vintage in step 2

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 (Option B2):

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}} \quad (3)$$

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* (%)

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 (*ex ante* option)

Step 4. Identify the Cohort of Power Units to be Included in the Build Margin

It was found that the most recent set of power plants which generate 20% of the country's electricity generated more power (MWh) in 2007 than the five most recently built power stations. As such, the weighted carbon emissions from the former were used to calculate the build margin.

For the first crediting period, the build margin emission factor will be calculated *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 (Option 1).

Step 5. Calculate the Build Margin Emission Factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EC_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (4)$$

Where:

$EF_{grid,BM,y}$ = Build 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 year *y* (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) will be determined as per the guidance in step 3 (a) for the simple OM, using options B1 and B2, using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

Step 6. Calculate the Combined Margin Emissions Factor

The combined margin emissions factor is calculated as follows:

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

Where:

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

The weightings used are as follows: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period.

Step 7. Calculate of the Baseline Emission *(BE_y)*

The baseline emissions (BE_y in t CO_2e) are the product of the baseline emission factor (EF_y in tCO_2e/MWh) multiplies with the electricity supplied by the project activity to the grid EG_y in MWh)

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

2. Project Emissions

a) From the Reservoir

As per the guidance in methodology ACM0002, there are no expected project emissions for hydropower plants which have a run-of-river reservoir with a power density larger than 10 W/m^2.

The Chau Thon hydropower project has a total installed capacity of 18 MW (or 18,000,000 W) and its run-of-river reservoir has a surface area[13] of 270,060 m^2. To calculate the power density, the below formula is used

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (7)$$

Where:

PD = Power density of the project activity, in W/m^2
Cap_{PJ} = Installed capacity of the hydropower plant after the implementation of the project activity (W).
Cap_{BL} = Installed capacity of the hydropower plant before the implementation of the project activity (W). For new hydropower 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 the new reservoir, this value is zero

The power density of the Chau Thon hydropower plant is therefore

PD= 18,000,000 (W) / 270,060 (m^2)[5] = <u>66.7 W/m^2</u>

As a result, the project emissions from the project activity are considered to be zero.

b) From Fossil Fuel Consumption by Backup Generators

In the first instance, if power is lost from at the project site, the power plant will draw power from the national grid system in order to serve critical systems. Should this first option fail, backup generators will be employed and this will result in project emissions. At this stage, as there is no plan for the use of backup generators the emissions from the generators *ex-ante* are considered zero, but generator use is included as a monitoring point in section B7.2 and the monitoring plan in section B7.2.

3. Leakage

As per methodology ACM002, version 9, the project owner does not need consider leakage.

Therefore:

$$LE_y = 0$$

[13] Project's environmental impact assessment, approved by the Nghe An Provincial People's Committee on November 28th 2007

(8)

4. Emission Reductions

Emission reductions are calculated as follows

$$ER_y = BE_y - PE_y - LE_y \quad (9)$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2e/yr)
PE_y = Project emissions in year *y* (t CO_2e/yr)
LE_y = Leakage emissions in year *y* (t CO_2e/yr)

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

Data / Parameter:	***NCV_i***
Data unit:	TJ per mass or volume of fuel
Description:	Net calorific value (energy content) per mass or volume unit of a fuel *i*
Source of data used:	IPCC default values
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is collected from the IPCC as national and / or local data is unavailable.
Any comment:	

Data / Parameter:	***Fi,j,y***
Data unit:	10^4t,$10^8$$m^3$
Description:	The quantity of fuel *i* (by mass or volume) consumed by the relevant power source *j,* in year(s) *y.*
Source of data used:	Report on the Operation of Vietnam National Electricity System in Years 2005-7: EVN/National Electricity System Dispatching Centre - Department for Electricity System Operation, Hanoi.
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data are used from Electricity of Vietnam (EVN), the only source for such information.
Any comment:	

Data / Parameter:	**Installed Capacity**
Data unit:	MW
Description:	Installed capacity of power plants serving the Vietnamese national grid system
Source of data used:	Masterplan 6, EVN
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data are used from Electricity of Vietnam (EVN), the only source for such information.
Any comment:	

Data / Parameter:	**Electricity Generated**
Data unit:	MWh
Description:	Electricity generation attributable to power source *j*
Source of data used:	Report on the Operation of Vietnam National Electricity System in Years 2005-7: EVN/National Electricity System Dispatching Centre - Department for Electricity System Operation, Hanoi.
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data are used from Electricity of Vietnam (EVN), the only source for such information.
Any comment:	

Data / Parameter:	**Internal Electricity Consumption**
Data unit:	%
Description:	The internal power consumption of power source *j*
Source of data used:	Report on the Operation of Vietnam National Electricity System in Years 2005-7: EVN/National Electricity System Dispatching Centre - Department for Electricity System Operation, Hanoi.
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data are used from Electricity of Vietnam (EVN), the only source for such information.
Any comment:	

Data / Parameter:	**$EF_{CO2,i}$**
Data unit:	tCO_2/TJ

Description:	The CO_2 emission factor per unit of fuel *i*
Source of data used:	IPCC default values
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is collected from the IPCC as national and / or local data is unavailable.
Any comment:	

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

Based on the proposed project's feasibility study, the annual electricity generated and supplied to the grid is 73,216 MWh. Therefore, according to formula (6) and (9), repeated below for convenience, the annual emission reductions in the first crediting period can be calculated as follows:

$BE_y = EF_y \times EG_y$ (6)

$ER_y = BE_y - PE_y - LE_y$ (9)

$ER_y = (73{,}216 \times 0.623304) - 0 - 0 = 45{,}636\ tCO_2e$

Thus the annual emission reductions attributable to the proposed project activity are 45,636 tCO_2e.

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

Year	Project Activity Emissions (tCO_2e)	Baseline Emissions (tCO_2e)	Leakage (tCO_2e)	Overall Emission Reductions (tCO_2e)
January 1st 2010 – December 31st 2010	0	45,636	0	45,636
January 1st 2011 – December 31st 2011	0	45,636	0	45,636
January 1st 2012 – December 31st 2012	0	45,636	0	45,636
January 1st 2013 – December 31st 2013	0	45,636	0	45,636
January 1st 2014 – December 31st 2014	0	45,636	0	45,636
January 1st 2015 – December 31st 2015	0	45,636	0	45,636
January 1st 2016 – December 31st 2016	0	45,636	0	45,636

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:	Net electricity exported to the national grid system from the project

Source of data to be used:	Electricity sales receipts for electricity to the EVN (Vietnamese state owned electricity company) and on-site metering systems.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	73,216
Description of measurement methods and procedures to be applied:	The data is directly measured by kilowatt hour meters at the project site and collated according to the organisation plan shown in Section B7.2. These meters are to be calibrated by the relevant authority in accordance with Article 6.3 of the Power Purchase Agreement. As part of the measurement process: • Hourly measurement and monthly recording will take place • Data is electronically archived during the crediting period and 2 years later • Two metering systems shall be used: one main and one backup
QA/QC procedures to be applied:	The data from electricity sales receipts will be cross checked against meter readings taken at the project site. A second backup metering system will be installed which can be used in the event of failure of the first. In addition to the calibration requirement described above, the data shall be kept in electronic form and sent to the project developer's offices for archiving (to be used in the event of on site computer failure).
Any comment:	

Data / Parameter:	**$EG_{y,backup\text{-}generators}$**
Data unit:	MWh
Description:	Net electricity supplied by backup generators in the event of hydropower station and grid electricity supply failure
Source of data to be used:	IPPC default values on emission factor of fuel to be used in order to calculate project emissions.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Unknown at this stage as the use of backup generators is only to be employed as a third option to supply power to the site in the event of power failure.
Description of measurement methods and procedures to be applied:	Records showing run hours, on and off load. Invoices for oil delivery.
QA/QC procedures to be applied:	The data from run hours will be cross checked against fuel purchase records.
Any comment:	

B.7.2. Description of the monitoring plan:

Quality assured monitoring is key to obtaining and verifying real, measurable data in order to quantify the emission reductions due to the project activity. The monitoring plan is described as follows:

1. Monitored Data

The monitored data is the net electricity quantity delivered to the national grid.

2. Monitoring Organisation

Roles and responsibilities are defined as follows:

Position	Responsibilities
Operational staff (site based)	• Ensure monthly meter readings are captured in standard format
Site Manager	• Ensuring monthly monitoring takes place • Initial check for anomalies (e.g. significant changes against previous readings or expected values) • Site record management • Communication of meter readings to a project manager • Attendance at annual verification
Project manager	• Collation of metered data from the project site • Collation of confirmation records from EVN purchasing subsidiary (see Annex 4) • Monthly cross-check of invoice and sales receipts against metered data

3. Metering System and Measurement Equipment

In gerenal, A Power Purchase Agreement (PPA) between the project developer and the EVN defines the metering arrangements and necessary quality control to measure electricity exported from the proposed project.

3a) Description of the metering system

- Net electricity generation of the project will be measured and monitored through the use of on-site metering equipments at the outgoing feeder of Chau Thon hydropower plant.
- There are two systems, one main and the other one is the backup system which is located near the main system.

3b) Main items of measurement equipment

- Measurement is by kiloWatt hour meters with a precision of 0.5 %, used for both metering systems.

5. Data Collection and Management

- The electricity supplied by the project to the grid will be automatically monitored by the two meter systems (main and backup).
- The data is measured on a half-hourly basis and monthly reports are generated.
- All the data in both systems is remotely and automatically monitored and read.
- 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.

6. Maintenance, Calibration and Accidence Treatment for Measurement Devices

- The measurement devices have to be initially and periodically calibrated by the authorities (i.e. electricity test centre of Electricity Company No 1 or relevant other organisations.)
- The kiloWatt hour meters shall be calibrated annually, whilst voltage and current transformers shall be calibrated once every five years.
- One of the parties concerned (i.e. project proponent or EVN) can require an extra calibration any time during the interval period between two calibrations
- In the event that the metering system suffers any failure, damage or unexpected problems, or if any errors in the main metering system are detected during calibration, the electricity exported will be identified as follows:
  - ✓ Using the results of the backup system
  - ✓ Should the backup system also suffer a breakdown, the electricity exported will be proposed by reconstructing data by means of trend analysis (taking a conservative approach).
- Any non-conformities of monitoring system detected shall be immediately reported and corrective actions taken.

7. Verification and Monitoring Report

- The project owner will prepare, arrange, and make available data for verification by an accredited Designated Operational Entity.
- An annual report describing electricity exported and emission reductions shall be generated from monthly recorded meter and invoice data.
- The site manager will be available to attend annual verification.

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):

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Mr. D. L. Shaw
Head of Consultancy Services
KYOTOenergy Pte. Ltd.

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Room 307, Number 10, Alley 95,
Chua Boc Street, Dong Da District,
Hanoi, Viet Nam

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:

CDM – Executive Board

As per the guidance of EB41 meeting report, the project activity is anticipated to start 01/6/2009 when the project proponent plans to sign the equipment supply contract.

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

30 years

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:

Upon commercial operation date, currently planned for 1st January 2011.

C.2.1.2. Length of the first crediting period:

7 years, January 1st 2010 – December 31st 2016

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

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C.2.2.2. Length:

>>

SECTION D. Environmental impacts

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

The impacts of the project as follows

A. Environmental Impacts During the Construction Phase

I. Impacts Relating to Waste:

1. Impacts to landscape and soil
    - The project will make terrain changes due to earth excavation and filling
    - The project will permanently occupy an area of 59.28 hectares in which a forestry area is 11. 15 hectares, agricultural land of 10.46 hectares, unused land of 38.52 hectares. This will require the compensation and resettlement of 16 households.
2. Impacts to atmosphere
    - Dust is an affect from land smoothing activities and construction material exploitation; in fact, air pollution due to land smoothing activities is one of the most significant pollution sources. In addition, the cement production at the mixing station and transportation activities also contribute to air pollution. An estimation of dust generation from the project during this phase is around 20.189 kg per month.

- Exhaust gases from the transportation, machine activities and domestic waste including CO, CO_2, NO_2 and SO_2. It is estimated that the amount of CO_2, NO_2, and SO_2 is approximately 8.73 kg, 0.339 kg, and 0.027 kg per shift respectively.
- Noise is generated from transportation and machine activities with an impact radius of 0.8 km. Noise also arises as a consequence of mine explosions with an impact radius of 3 km. The project is located far from the residential areas however (~ 8-9 km) so its impact on local inhabitants is negligible.
- Impacts from domestic waste: organic domestic waste will generate CH_4, NH_3, H_2S. It is estimated that the load of domestic waste is around 60 tonnes per annum.

3. Impacts to water
    - Water pollution from construction activities: waste earth in the construction can affect the surface water quality of the rivers and streams in the area.
    - Other solid waste such as domestic waste, plastic bags etc. can be dumped into the water bodies unless proper management is carried out at the site.
    - Other pollution sources: waste oil and degreaser around 2,880 liters per year.

II. Non-Waste Related Impacts

1. Erosion of soil: during the construction phase, the possibility of erosion can increase, especially in the rainy season.
2. The project has some impacts on ecosystems as follows:

a. Impact Flora: A total layout area of the project is around 76 hectares which generally has poor vegetation cover. Some impacts of the project on flora are wood exploitations for fire and cooking. Hence, the project owner should pay attention to educating and increasing awareness of workers in protecting nature and preventing forest fires. In the reservoir area, there are some natural forests, secondary forest which will be sunk in the water. The environmental impact assessment concludes there are no valuable species in this area. Besides this, in the construction site, some 5 hectares of forest will be cut and it will have some impacts on flora and wildlife.

b. Impacts on fauna
    - The construction of the project can destroy the habitat of some animals. Noise from mine explosions and working of vehicles and machines can also impact on the wildlife.
    - The project owner should pay attention to workers hunting wild animals.
    - In general, negative impacts on nature during the construction phase are unavoidable but they are not highly significant and are temporary.
    - Impacts to aquatic ecosystems: the construction of the project can impact on the ecosystems i.e. the water could become more opaque, the habitats of some aquatic organisms may be lost due to the construction of weir. And this might also prevent some fish species moving up the upstream. However, these impacts are local and temporary. The construction of a run-of-river reservoir can create a new aquatic ecosystem.

3. Impacts on society and inhabitant's life
    - Permanent loss of some land
    - There are 25 persons who have to resettle due to the project

- The project does however have many positive impacts on economy and local inhabitant's life such as providing electricity for Vietnam grid which is necessary for the economic development, allowing the expansion of industrial production, improving peoples' the quality of life etc. The construction of the project will also bring many jobs to local residents, promote the local economic development, and improve the infrastructure of the locality. The creation of a reservoir helps promote agricultural production activities, control the flooding etc.

B. Environmental Impacts During the Operation Phase

- Impacts on microclimate: the construction of the run-of-river reservoir helps moderate the local climate. It also provides water for the locality and can prevent flooding.
- At the early stage of the operation phase, the water quality of the reservoir can be reduced due to the decay of organic matter in the reservoir's bed.
- Sedimentation can have an impact on the reservoir, however it is not considered a significant impact.
- There could be some changes downstream of the project after the weir .i.e. a change of flow and water quality after the discharging point of tailrace.
- The creation of the reservoir facilitates the development of plant communities. This is a positive impact on biodiversity.
- After the project comes to operation and vegetation cover is developed, it is possible that some animal life will be enhanced around the reservoir area.
- In the reservoir, zooplankton, phytoplankton and algae can develop strongly as a consequence of eutrophication and bring down water quality.

C. Risks Due to the project

a. During the construction phase: it is possible to occur some risks to the environment as well as to health and safety .i.e. landslides can occur with the construction site especially in the rainy season, breakdown of construction items, mine explosion, forest fires, car accidents or risks with mines and bomb which are left from the Vietnam War.
b. During the operation phase: risks at this stage can be breakdown of weir or penstock, or from fires. But these are no more than at any other hydropower station.

The mitigation measures for the negative impacts from the project as follows

A. Measures for Mitigating Identified Impacts During The Construction Phase

a. Management measures: Making a good construction plan and schedule, arranging a good place for workers' living and managing workers properly. Strictly controlling and managing labour safety in the construction activities, materials and handling of fuel.
b. Technical measures: Spraying water to prevent dust, arranging support areas at the end of main wind directions, covering trucks carrying materials. Vehicles and machines must be calibrated to ensure the technical standards, keeping the working and living places clean, planting trees, etc.
c. Reduction of the impacts on the water environment: for oil, gasoline, lubricant as well as their wastes etc, they have to be managed strictly and then they will be replenished and removed in a safe manner by a third party contractor with the necessary experience and developed handling procedures required for the task. Staff onsite will however be trained

so they are aware how potentially damaging to the environment the transformer oil can be. The stores of these are from water sources and bodies and in suitable places with covers or containers. For wastewater from the construction activities such as stone washing, cement mix stations etc., they have to be collected treated properly. The water treatment measures have to meet Vietnam's environmental laws. For domestic wastewater, it must be treated before discharging into the environment.

d. For solid waste, there are two landfills with an area of 0.3 hectare for each. For both solid waste from the construction and domestic waste, they will be collected daily. All these items of waste shall be separated and disposed of properly in suitable landfills.
e. Reduction of impacts on soil resources, landscape and erosion: applying suitable measures as designed and approved in the Environmental Impact Assessment.
f. Reduction of impacts to ecosystems: the project should reforest some of the surrounding area in order to offset the forest area lost. Trees should also planted around the reservoir to prevent erosion. At the same time, strictly prohibiting all illegal hunting and cutting activities.
g. Preventing accidents, fires, explosions, breakdowns in the construction phase, ensuring the safety of labourers by providing appropriate equipment and training.
h. The project owner will have to follow Vietnamese Laws to implement compensation and resettlement activities.

B. Measures to Mitigate Impacts in the Operation Phase

a. Reducing sedimentation and preventing erosion - as above, the forest has to be developed around the project area.
b. Reducing pollution of reservoir's water by cleaning the reservoir's bed.
c. Collecting and treating all wastewaters and solid wastes generated from the operation of plant and workers.
d. Oil used in the transformer will be replenished and removed in a safe manner by a third party contractor with the necessary experience and developed handling procedures required for the task. Staff onsite will however be trained so they are aware how potentially damaging to the environment the transformer oil can be.
e. Implementing an environmental monitoring and management plan, complying with all related Vietnamese laws, regulations and standards on environmental protection.

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:

The environmental impacts of the project are not considered significant by Vietnamese authorities, the Environmental Impact Assessment report (EIA) was approved by the Nghe An Provincial People's Committee on November 28th 2007.

SECTION E. Stakeholders' comments

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

The stakeholder meeting for the project was conducted in the Administrative Building of Chau Thon Commune People's Committee, Que Phong District, Nghe An Province, Vietnam at 0900hrs on July 30th, 2008. Personal invitations[u25] were sent to community leaders, local People's Committee representatives, media etc. and public notices of the planned consultations were placed in *National Resources and Environmental Newspaper* which is widely published and read in provinces. Across the consultation, presentations were made by the project owner and consultant who outlined the planned project activity in a non-technical manner (including environmental, social and technological considerations), climate change, the role of the Clean Development Mechanism and annual emission reductions potential. In addition, questionnaires were circulated and filled in by the attendees. In all, there were 45 participants attending the meeting.

Figure E.1 Picture of the local stakeholder meeting in Chau Thon Commune in 30/07/2008

E.2.	Summary of the comments received:

Local stakeholders appreciated the positive aspects of the project such as job creation, electricity supply etc. However, some also expressed concern that the project might have some negative impacts to the environment and their life. But they agreed that the scale of these impacts is small.

- ✓ 50% of attendees worry about impacts on the environments, natural resource, especially impacts on ecosystems. It is obvious that some of these impacts are unavoidable but the scale of them is low and temporary as stated in the Environmental Impact Assessment report which has been approved the local authority. It states that the biodiversity in the area is quite poor and there are no valuable species living there. Moreover, the construction of a run-of-river reservoir will somewhat help to enhance biodiversity in the area.
- ✓ Around 25% of attendants questioned whether the construction of the project might lead to releases of substances, pollutants or any hazardous, toxic or noxious substances or risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater which could be harmful to human health or raise concerns about actual or perceived risks to human health and / or the environment. To answer these concerns, the project owner confirms that all of these have been presented in the EIA and the project owner also proposes many solutions to eliminate them.
- ✓ Some of attendants (15%) think that the Project could cause noise and vibration or release of light, heat energy or electromagnetic radiation; risk of accidents during construction or

operation; be susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions; cause the loss of protected and / or important or sensitive species of fauna or flora. Likewise for other impacts from the project, all these impacts have been clearly stated in the EIA that it is unlikely that they can occur.

- ✓ A few attendants raised concerns that around the location there may be densely populated areas or buildings employed by sensitive uses e.g. hospitals, schools, places of worship. Or there is risk to land around the location which is protected or not under international or national or local legislation, which are important for the landscape. In fact there are none of those kinds of areas around the project. The local authorities attending the meeting have confirmed the information.
- ✓ 43% of attendants say that the project will not create the jobs for people. In fact the project has created, is creating and will create many jobs for local inhabitants. Many other attendants have confirmed this information.
- ✓ 50% people say that the project will affect on the land use. This is an unavoidable impact. The project owner confirms that they will compensate consistently and comply with Vietnamese laws and regulations to handle it.
- ✓ Many of the attendees (70%) show that the project is in a location where it is likely to be highly visible to many people because it is close to roads. However this impact will be mitigated by reforestation around the project site as well as applying suitably covering measures.

In general, the project received positive response from local communities. They were expecting positive impacts on social, economic and environmental aspects because of the project. Moreover, all concerns about environmental aspects have been addressed by the project owner prior to the implementation of the project.

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

The project owner assured that:

- The project's construction and operation would be in line with the environmental and health and safety laws of Vietnam;
- As the project is run-of-river with a small run-of-river reservoir, its environmental impact is relatively low;
- That reforestation of the land will take place.

In addition, the participants were informed of the voluntary pledge of 2.5% of CER revenue by the project developers to sustainable development and cultural aspects such as:

- ✓ Sponsoring 100 tonnes of rice for people affected by flooding in 2007
- ✓ Supporting for 6 households to eliminate very bad houses by building new houses in 2007
- ✓ Developing infrastructure for local inhabitants around the project

Annex 1

CONTACT INFORMATION OF PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Neither public nor ODA funding from an Annex 1 country was applied for by the project proponent for the project.

ANNEX 3 - BASELINE INFORMATION

Operating Margin		A	B	C	D	E
		Fuel Consumption 2005-7	Emission Factor	Carbon Dioxide Per Annum	Annual Output 2005-7	tCO2 / MWh
		TJ	tCO2/TJ	tCO2 (= A * B)	GWh	(= C / D)
Coal		301,193	98.3	29,607,273	28,529	1.038
Fuel Oil		22,425	77.4	1,735,713	1,892	0.917
Diesel Oil		54,391	74.1	4,030,366	5,503	0.732
Natural Gas		840,675	56.1	47,161,860	78,388	0.602
Import from China		0	0	0	3,979	0.000
				82,535,212	**118,290**	**0.698**

Build Margin		A	B	C	D	E
	Commercial Operation Date	Fuel Consumption 2007	Emission Factor	Emissions	Generation (2007)	Emissions Rate
	Year	TJ	tCO2/TJ	tCO2/y	GWh	tCO2 / MWh
				tCO2 (= A * B)		(= C / D)
Option 2. Additions represents 20% of the system generation						
Quang Tri (Hydroelectric)	2007	0	0	0	64.0	0.000
Ca Mau 1 (Natural Gas)	2007	6,634	56.1	372,145	691.0	0.539
Uong Bi MR 1 (Coal)	2007	4,800	98.3	471,840	520.0	0.907
Cai Lan (Diesel)	2007	748	74.1	55,404	81.0	0.684
Se San 3A (Hydroelectric)	2006	0	0	0	345.0	0.000
Cao Ngan (Coal)	2006	4,108	98.3	403,786	445.0	0.907
Srok Phu Mieng (Hydroelectric)	2006	0	0	0	252.0	0.000
Se San 3 (Hydroelectric)	2006	0	0	0	1,128.9	0.000
Dam Phu My (Natural Gas)	2006	1,440	56.1	80,784	150.0	0.539
Formosa (Coal)	2004	10,274	98.3	1,009,919	1,113.0	0.907
Na Duong (Coal)	2004	6,868	98.3	675,094	744.0	0.907
Phu My 2.2 (Natural Gas)	2004	48,038	56.1	2,694,954	5,004.0	0.539
Phy My 4 (Natural Gas)	2004	24,011	56.1	1,347,005	2,032.7	0.663
Can Don (Hydroelectric)	2004	0	0	0	312.0	0.000
Phy My 3 (Natural Gas)	2004	37277	56.1	2,091,228	3,883.0	0.539
		144,197		**9,202,160**	**16,765.6**	**0.549**

A	Estimated operating margin emission rate	tCO2/MWh	**0.697735**
B	Estimated build margin emission rate	tCO2/MWh	**0.548872**
C	Estimated baseline emission rate*	tCO2/MWh	**0.623304**

Annex 4

MONITORING INFORMATION

1. *Power purchasing company name*: Electricity of Vietnam (EVN)

2. *Connection point details:* The electricity generated by the project will be delivered to the Vietnam national grid via a new 35 kV transmission line from Chau Thon hydropower plant to Song Quang hydropower plant, and then it is loaded by a 110 kV single circuit Song Quang-Truong Banh transmission line from a 110 kV transformer station of the Song Quang hydropower plant to a 110 kV Truong Banh transformer station to connect to National Grid through a 110 kV double-circuit Truong Banh-Sang Le transmission line

3. *Project Manager Name*: Mr Nguyen Van Ngoc

4. *Site Manager Name:* Mr Pham Van Te