



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

CONTENTS

- A. General description of project activity
- B. Application of a baseline and monitoring methodology.
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan



CDM – Executive Board

SECTION A. General description of project activity
A.1. Title of the project activity:

Project title: Dak Srong 2 Hydropower Project.
 Version 1.15-1: Prepared for host country approval purpose and validation processes
 Completion date: 11/02/2009

A.2. Description of the project activity:
Project Entity and Purpose of the Project Activity

The Dak Srong 2 hydropower project is being developed by Hoang Anh Gia Lai Hydropower Joint Stock Company and is the first hydropower project being set up by the company. The proposed project activity aims to construct and operate a run-of-river hydropower project. Being a run-of-river (rather than accumulation reservoir plant), it offers an environmentally friendly solution to growing energy demand. It will be located in Yang Nam, Ya Ma, and Dak Hninh Communes, Kong Chro District, Gia Lai Province in the highland area of Vietnam and is hereafter referred to as “the project activity”. Gia Lai is located in the central mountainous region of the country, which is one of the poorest areas in Vietnam¹. The nearest habitation to the project is situated 2.5 km from the project site. The proposed project utilises water resources of the Ba River, which links to the Da Rang River and eventually to the East Sea of Vietnam.

The project will generate approximately 91,816 MWh/pa of power by using three turbines, resulting in an estimated emission reductions of 48,773 tCO₂ / pa during the first seven year crediting period. This will offset the combustion of thousands of tonnes of fossil fuels, which are used to generate electricity for the Vietnam electricity grid., In doing so, this project will help preserve non-renewable resources by promoting the exploitation and use of renewable resources. 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. The project has positive impacts with respect to the environment (offsetting fossil fuel use and lowering greenhouse gas emissions), society (providing jobs, development of roads), technologically (technology transfer) and economy (satisfying growing energy demands to allow the country and region to develop and alleviate poverty). In order to quantify the sustainable development contribution of this project, the project owner has voluntarily agreed to donate 2 % of the CER revenue from the project towards sustainable development initiatives. However, in the context of high inflation and interest rates in Vietnam, the project is financially unattractive and the support of the CDM is imperative if the project is to be executed and emission reductions realised.

¹ The province has been classified as Class C by No.24/2007/ND-CP dated February 14, 2007 and Law No.14/2008/QH dated June 03rd 2008, and hence eligible for highest tax exemption.

CDM – Executive Board

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)	<u>Private Entity</u> : Hoang Anh Giai Lai Hydropower Joint Stock Company (as the project owner)	No
Switzerland	<u>Private Entity</u> : Bunge Emissions Holdings Sarl	No

Hoang Anh Gia Lai Hydropower J.S.C: a company set up for generating and supplying electricity, based in Pleiku City, Gia Lai province, 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 its 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.:

Gia Lai Province

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

Yang Nam, Ya Ma, and Dak Hninh Communes, Kong Chro 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 is situated on the Ba River, in the central highland province, which joins with the Da Rang River to run into the East Sea. The Ba River originates from the mountains Ngoc N'Go and Ngoc Roo with the height of 1,500m. The terrain around the project site is quite plain while after this area, there are many water falls in the river and it meanders strongly. With a gross head of 41m, this area has facilitated the construction of the proposed hydropower plant. The nearest town and city to the project site is Kong Chro town (~15 km South), Pleiku City (~ 150 km Southern East). Figure A.2 shows the location of the project.

CDM – Executive Board

The co-ordinates of the site are latitude of 13°41'45"N and longitude of 108°33'30"E.

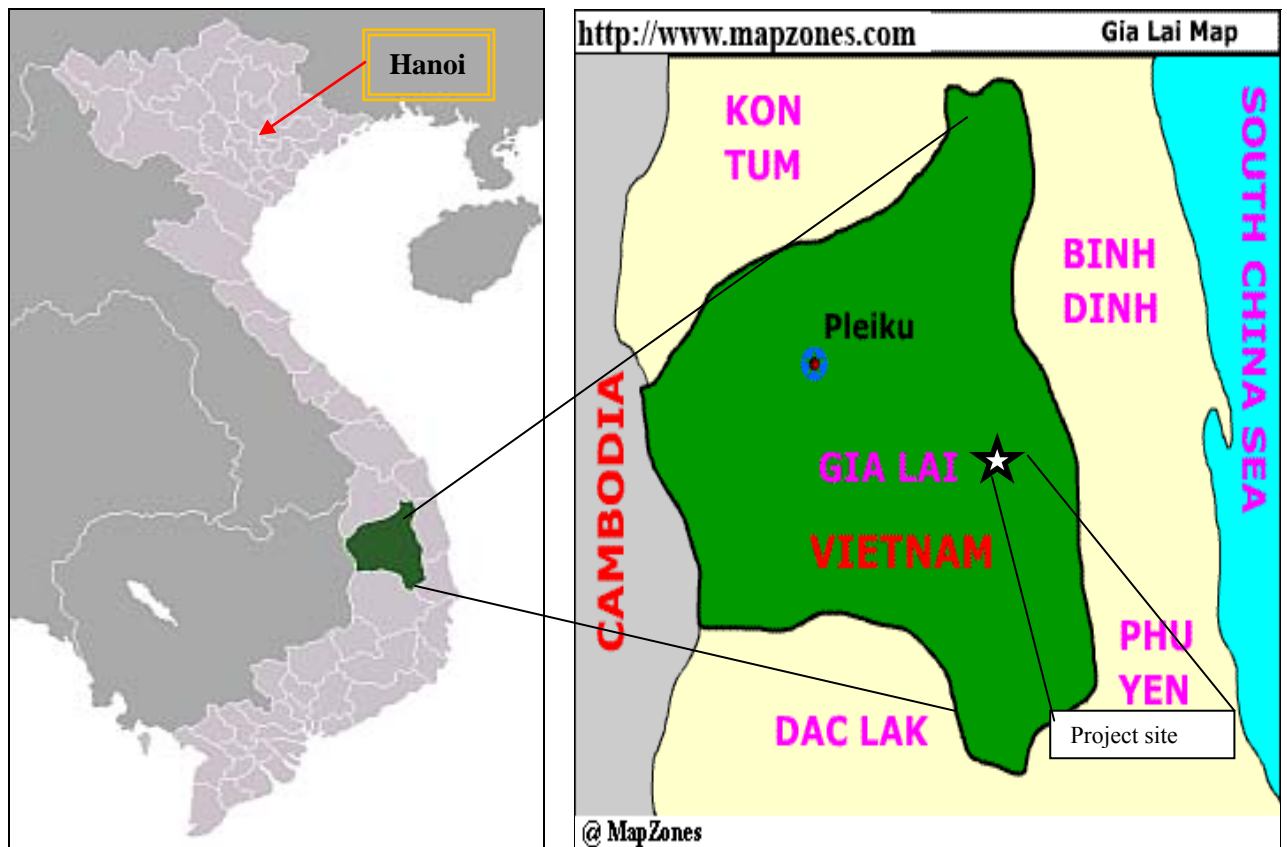


Figure A.2. Project location

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, a penstock, a powerhouse (containing turbines and generators) and a tailrace as shown in Fig. A.3. The installed capacity of the project is 24 MW with total expected annual net generated electricity of 91,816 MWh per annum. The main items of equipment such as turbines, generators, governors etc are imported from China. This will contribute to the transfer of technology to Vietnam. The electricity generated by the project will be delivered to the Vietnam national grid via a new single-circle 110 kV transmission line.

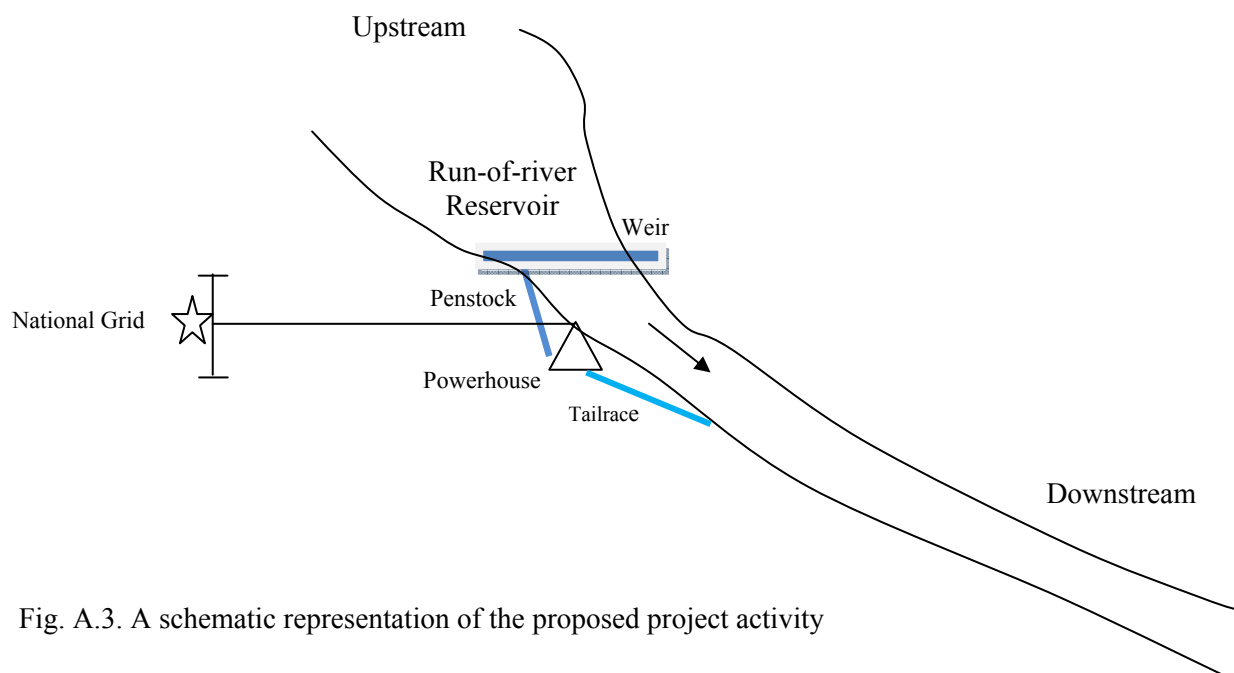


Fig. A.3. A schematic representation of the proposed project activity

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 clearance, development or resettlement, 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 resulting in a relatively small amount of project emissions (detailed in Section B6). The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity

Table A.2. The main technologies used in the project, imported from China.

	Items	Specification
Turbines	Quantity	3
	Capacity	8,290.2 kW
	Type	HLA551C-LJ-176
	Design head	37.5 m
	Rated speed	300 rpm
	Rated efficiency	93.5 %
	Turbine discharge at design head	24.11 m ³ /s
Generators	Quantity	3
	Capacity	8,000 kW
	Type	SF 8,000-20/3250
	Cos α	0.8
	Rated speed	300 rpm
	Runaway speed	527.6 rpm
	Rated voltage	6.3 kV
	Rated Efficiency	96.50%

CDM – Executive Board

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 48,773 tCO₂e as shown in Table A.3. The project will employ a renewable crediting period and the total emission reductions are estimated to be 341,411 tCO₂e 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 ₂ e
01/05/2010-31/04/2011	48,773
01/05/2011-31/04/2012	48,773
01/05/2012-31/04/2013	48,773
01/05/2013-31/04/2014	48,773
01/05/2014-31/04/2015	48,773
01/05/2015-31/04/2016	48,773
01/05/2016-31/04/2017	48,773
Total estimated reductions (tCO₂e)	341,411
Total number of initial crediting years	7
Annual average of the estimated reductions over the crediting period	48,773

A.4.5. Public funding of the project activity:

There is no public funding from Annex 1 Parties 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 09.

As the project's total installed capacity is 24 MW (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)



CDM – Executive Board

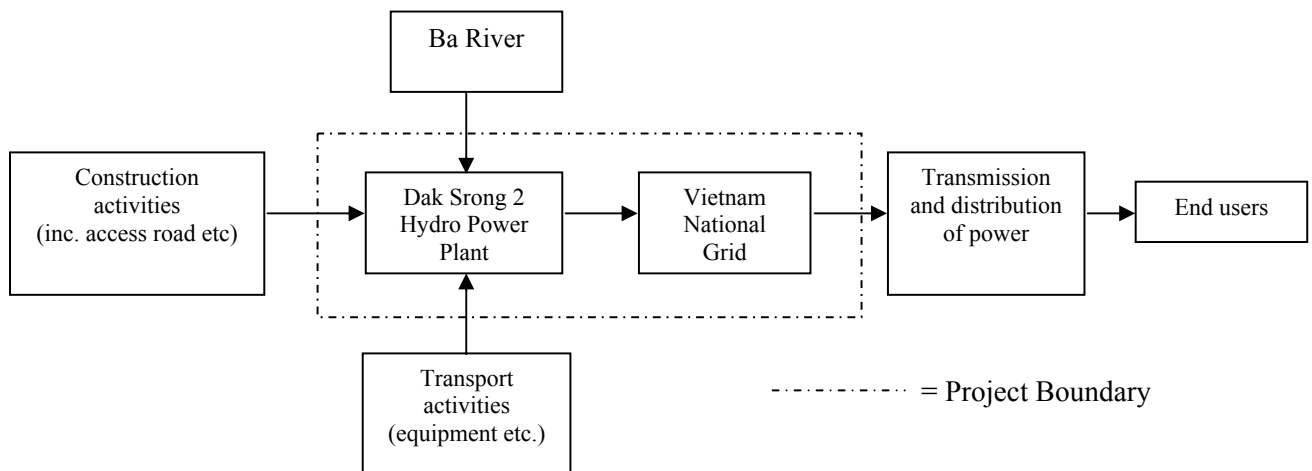
B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

	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 ACM002, is greater than 4 W/m ² .	The new reservoir associated with this project has a power density of 4.76W/m ² as defined in ACM002
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 ACM002, the project boundary is the Vietnam national grid system, which mainly comprises 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 ACM002/Ver 09, the following sources and gases are included the project boundary

CDM – Executive Board

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 ₂ O	No	
Project activities	Run-of-river hydropower plant with the power density of a run-of-river reservoir of 4.76 W/m ²	CO ₂	No	Minor emission source, excluded
		CH ₄	Yes	As per the guidance in the ACM0002 (Version 08), the project emission is 90 kg CO ₂ e/MWh
		N ₂ O	No	Minor emission source, excluded

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 sale 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 distinction made by the EVN is categorising power stations by type (coal, gas, hydropower etc.), informally by geographical location (North, Central and South) and ownership (state, independent power producer, “build-operate-transfer”). Over the period 2001-2005, total installed capacity of power increased from 6,192 MW in the year 2000, to 11,298 MW in 2005 and the greatest contributors are fossil fuel fired plants.²

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.

² Source: Electricity of Vietnam

CDM – Executive Board

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 would be reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity is additional and would not have occurred 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, though additional barriers have also been highlighted.

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:

- The proposed project activity undertaken without being registered as a CDM project activity;
- Construction of a fossil-fuel fired power plant or any other energy renewable power plants with equivalent amount of annual electricity generation;
- 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 neither realistic nor credible because, with respect to energy, the Hoang Anh Gia Lai Hydropower J.S.C is only involved in hydropower project development and therefore a coal fired power station or wind farm is not an option. Besides, solar and wind power projects

CDM – Executive Board

are of very small scale and are rare in Vietnam. Being in a mountainous location with no access roads, it is an unsuitable site for a fossil fuel power station for either the Project Entity or state to build a fossil fuel powered plant.

- Alternative (c), which is a continuation of the current situation (no project activity or other alternatives undertaken) with electricity 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 is alternative (c) and this is 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, version 05.2. 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, version 05.2 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”; 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.

Guidance on the Assessment of Investment Analysis states that, “In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR”. Keeping the above in view, the project developer has selected the commercial lending rate offered by commercial banks in Vietnam at the time the decision making. At the time of decision making, the State Bank of

 CDM – Executive Board

Vietnam's base rate was 8.25%³. The commercial lending rate is regulated by the Civil Code in Vietnam. As per the Civil Code, commercial banks cannot charge a rate of interest more than 1.5 times the prime rate⁴. Thus, 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 state rate 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*⁵.

The benchmark of 12.38 % chosen, therefore, fulfils all the criteria laid down by the Additionality Tool⁶ 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 lending rate for medium term loan has been stated as 13.7%⁷ (the actual rate paid when interest is compounded over the year).

Finally, and in addition to the above, the EVN (State Utility) has also determined the internal rate of return for investment into hydropower projects should be over 12%⁸. The benchmark of 12.38% therefore fulfils all the criteria laid down by the Additionality Tool and is conservative.

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

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

³ <http://www.sbv.gov.vn/vn/CdeCSTT-TD/tracuu.jsp>

⁴ Civil Code, Article 476.

⁵ The reference cited can be accessed at the website given vide footnote (1). The publication is from a Multi National Bank – HSBC

⁶ And also the *Guidance on the Assessment of Investment Analysis*, Point No.11 (page No.3)

⁷ IMF Country Report No. 07/386, Vietnam – Statistical Appendix, Table 21. The report can be accessed at <http://www.imf.org/external/pubs/ft/scr/2007/cr07386.pdf>

⁸ Electricity of Vietnam Masterplan 6

CDM – Executive Board

Table B.3: Key input parameters

Parameters	Value	Basis
Installed capacity (MW)	24	Feasibility study
Plant load factor (%)	44.6%	Feasibility study
Annual power supplied to the grid (MWh)	91,816	Computed
Auxiliary consumption (as percent of generation)	2.0	General norm, transmission and distribution losses
Total Investment (million VND)	539,797	Feasibility study
Loan: equity ratio	50:50	Feasibility study
Power tariff (Dong/ kWh)	732.96	Feasibility study
O&M cost (as percent of project cost)	1.0	Decision 2014/QD-BCN, dt on 13.6.2007
Escalation in O&M cost (per annum)	3%	Estimate
Insurance (as percent of project cost)	0.25	Estimate
Interest rate on term loan – Commercial bank	12%	Feasibility study
- Equipment loan	8.5%	Feasibility study
Loan repayment period (years)	10	Feasibility study
Initial moratorium period (years)	1	Estimate, conservative
Depreciation – Equipment	10%	Present practice in Vietnam
-Civil works	5%	Present practice in Vietnam
Natural Resource Tax (as percent of revenue)	2.0	Ordinance on Natural Resource Tax
Enterprise Income Tax	0-25%	Law No 14/QH/2008 dt.03/6/2008

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 dated 14th February 2007 and Law No 14/QH/2008, dated on 03/6/2008. 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 Law and 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. Even with such allowances and strictly adhering to the Decree in accounting for expenditures, the project is unable to generate a return commensurate with the benchmark.

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 depreciated⁹, the question of salvage value does not arise. Based on the above, the project IRR works out to 9.27 % as against the benchmark return of 12.38 %.

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

⁹ Including the additional investment provided in the 16th year as permitted by the Guidance on the Assessment of Investment Analysis (item No.1)

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

	Project IRR	Benchmark
Values	10.36 %	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 Operation and Maintenance (O&M) expenses has been taken only at 3% as against the inflation rate of over 25%¹⁰ 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. 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	8.93%	10.36%	11.78%
Project cost	11.87%	10.36%	9.15%
O&M cost	10.49%	10.36%	10.23%
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%.

¹⁰ <http://www.iht.com/articles/ap/2008/05/27/business/AS-FIN-ECO-Vietnam-Inflation.php>, and <http://www.time.com/time/world/article/0,8599,1817174,00.html>

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 2008¹¹ and still had gone up further to 25.2 % in May. 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 14.07%. It is with respect to the above background that 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 of the project. The foregoing paragraphs have already established the additionality of the project based on investment analysis. However, since the project faces other 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 the lack of availability of a 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 habitation is about 2 km from the site. The location and lack of 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 want of infrastructure. Since it is located in a deprived rural area and human habitat is quite far away, the site does not have proper physical infrastructure. Therefore, the project participants will be required to spend approximately VND 1.8 billion to construct access roads to the

¹¹ <http://www.iht.com/articles/ap/2008/02/28/business/AS-FIN-ECO-Vietnam-Inflation.php>, downloaded on August 15, 2008

 CDM – Executive Board

project site. Whilst the construction of road no doubt brings benefits to the location in terms of improved infrastructure, the additional cost does negatively impact the profitability of the project.

The project also runs the risk of technological failure; the feasibility study concludes that the area, where the project is located, suffered earthquakes with intensity of 6 (MSK-64 scale) in the past¹¹. Being in such a remote area, it means that the computation of O&M cost is very conservative for this project. Should there be a technological failure, access to the site could be difficult (and therefore costly) to rectify and some items of plant would be required to be imported.

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 Dak Srong (only 21% of projects). This is discussed further in the common practice analysis below.

Other Barriers- Policy. Private investment has become possible in Vietnam only recently and the EVN does not have any policies in place to promote the development of hydropower plants, e.g. ,through preferential tariffs or incentives. 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). 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 hydropower projects located in areas such as those where the proposed project is planned is discouraged, 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. Indeed, the share of hydropower as a percentage of total generation capacity has fallen in Vietnam over the last five years as the most accessible and / or economically attractive sites have already been developed by the Government.(please refer to table B7).

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 Vietnam¹², those

CDM – Executive Board

that have permission granted to build power plants from 2006-2008¹³ and those that fall into the build own operate (BOO) or build operate transfer (BOT) category of projects¹⁴:

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
23	Ngoi Bo, Lao Cai	34	VINACONEX	State owned IPP
24	Binh Dien	34	Binh Dien Hydropower JSC	Large private

¹³ EVN Masterplan for Electricity production 2005-2015

¹⁴ 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>

CDM – Executive Board

				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 Constrecton Co.	State owned IPP
46	Krong Ma, Dak Lak	11	Song (River) Da Constrecton 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 Constrecton Co.	State owned IPP
50	Ry Ninh 2, Gia Lai	8.5	Song (River) Da Constrecton 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

CDM – Executive Board

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 Constrectio n Co.	State owned IPP
59	Nam An, Ha Giang	6	Song (River) Da Constrectio n 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:

- A 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 a few that would cross the large scale threshold of 15MW generation capacity as Dak Srong 2 does (only 21% of projects).

Hence, construction of hydropower plants of the size of Dak Srong 2 by private sector is not a common practice in Vietnam¹⁵.

Further, the companies that have been identified as private investors have been found to be large corporations. Hoang Anh Gia Lai Hydropower J.S.C, the developer of the Dak Srong 2 project is made up of individuals and private companies and therefore capital mobilisation might not be that easy.

The fact that setting up of hydro power plants such as Dak Srong 2 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 Hoang Anh Gia Lai, the project developer, there is no state involvement and its shareholders are individuals and small private 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 Dak Srong 2 hydropower 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 Dak Srong 2 hydropower plant to overcome the barriers and contribute its mite to the global emission reduction effort.

Perhaps the most important barrier is inflation experienced by the country. The country had never experienced inflation witnessed since mid-late 2007. In addition to price inflation, interest rates have been raised sharply in a bid to curb rising costs and this has led to a large number of hydropower plants' development being suspended due to unfavourable economic conditions. The CDM will enable the Dak Srong 2 hydropower plant being developed despite all these problems, and ensure emission reductions can take place.

Serious consideration of CDM

The CDM benefit was identified by the Board of Directors of the Dak Srong 2 hydropower plant project as imperative to make the project financially attractive. A resolution to this effect was passed by the Board of Directors on 30th October 2007, a copy of which has been furnished to the DOE. The Project Proponent had even taken actions to secure CDM status before the resolution was passed by the Board. After the Board accorded approval, a contract was signed with a CDM consultant on 12th March 2008. Correspondence and contracts relating to this have also been furnished to the DOE. The project activity started with the Project Proponent signing the construction contract on the 25th January 2008. It could be seen from the above that the PP had taken simultaneous action to secure CDM status with the

¹⁵ As the market has not become transparent yet, published information on power plants are far and few. Therefore, as a conservative measure, the ownership has been marked as 'private' in respect of those plants for which no information could be publically found. Therefore, the private owned power projects could be less than what has been indicated in the table, thus further reinforcing the contention that setting up of Dak Srong 2 type of projects in private sector is not common practice.

CDM – Executive Board

implementation of the project. Therefore, the project activity fulfils both the conditions stipulated by EB vide annex 46 in its 41st Meeting.

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, version 09 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

CDM – Executive Board

Table B.7. Contribution of low cost and “must run” sources to overall power generation in Vietnam¹⁶

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 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 CO₂ emission factor in year y (tCO₂/MWh)
 $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
 $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/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:

- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
 $FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)

¹⁶ Source: EVN data and interview with EVN expert (attended by DOE)

CDM – Executive Board

- $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
 $EF_{CO_2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (t CO_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):

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \cdot 3.6}{\eta_{m,y}} \quad (3)$$

Where:

- $EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (t CO_2 /MWh)
 $EF_{CO_2,m,i,y}$ = Average CO_2 emission factor of fuel type i used in power unit m in year y (t CO_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).

CDM – Executive Board

Step 5. Calculate the Build Margin Emission Factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/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 CO₂ emission factor in year y (tCO₂/MWh)
 $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
 $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
 m = Power units included in the build margin
 y = Most recent historical year for which power generation data is available

The CO₂ 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 CO₂ emission factor in year y (tCO₂/MWh)
 $EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)
 w_{OM} = Weighting of operating margin emissions factor (%)
 w_{BM} = Weighting of build margin emissions factor (%)

The weight 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 CO₂e) are the product of the baseline emission factor (EF_y in tCO₂e/MWh) multiplied 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) Due to the Reservoir

The Dak Srong 2 hydropower project has a total installed capacity of 24 MW (or 24,000,000 W) and its run-of-river reservoir has a surface area of 5,037,000 m². 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/m²

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 (m²)

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 (m²). For the new reservoir, this value is zero

The power density of the Dak Srong 2 hydropower plant is therefore

$$PD = 24,000,000 \text{ (W)} / 5,037,000 \text{ (m}^2\text{)} = \underline{4.76 \text{ W/m}^2}$$

Because the power density of the project is greater than 4 W/m² and less than or equal to 10 W/m², the project emissions are calculated as follows

$$PE_y = \frac{EF_{Res} \cdot TEG_y}{1000} \quad (8)$$

Where:

 CDM – Executive Board

PE_y = Emission from reservoir expressed as tCO₂e/year

EF_{Res} = is the default emission factor for emissions from reservoirs, and the default value as per EB 23 is 90 kg CO₂e/MWh

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads in year y (MWh)

The annual emission from the reservoir of the Dak Srong 2 hydropower plant is therefore

$$PE = \frac{90 \times 93,960}{1000} = 8,457 \text{ W/m}^2$$

b) Due to the use of Backup Generation

The project does not include backup generators.

3. Leakage

As per methodology ACM0002, version 09, the project owner does not need consider leakage.

Therefore:

$$LE_y = 0 \quad (9)$$

4. Emission Reductions

Emission reductions are calculated as follows

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

Where:

ER_y = Emission reductions in year y (t CO₂e/yr)

BE_y = Baseline emissions in year y (t CO₂e/yr)

PE_y = Project emissions in year y (t CO₂e/yr)

LE_y = Leakage emissions in year y (t CO₂e/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>i</i>
Source of data used:	IPCC default values
Value applied:	
Justification of the choice of data or description of	Data is collected from the IPCC as national and / or local data is unavailable.

CDM – Executive Board

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$F_{i,j,y}$
Data unit:	$10^4\text{t}, 10^8\text{m}^3$
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.

CDM – Executive Board

applied :	
Any comment:	

Data / Parameter:	Internal Electricity Consumption
Data unit:	%
Description:	The internal power consumption of power source <i>j</i>
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>i</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 91,816 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:

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

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

$$ER_y = (91,816 \times 0.623304) - 8,457 - 0 = 48,773 \text{ tCO}_2\text{e}$$

Thus the annual emission reductions attributable to the proposed project activity are 48,773 tCO₂e.

CDM – Executive Board

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

Year	Project Activity Emissions (tCO ₂ e)	Baseline Emissions (tCO ₂ e)	Leakage (tCO ₂ e)	Overall Emission Reductions (tCO ₂ e)
01/05/2010-31/04/2011	8,457	57,229	0	48,773
01/05/2011-31/04/2012	8,457	57,229	0	48,773
01/05/2012-31/04/2013	8,457	57,229	0	48,773
01/05/2013-31/04/2014	8,457	57,229	0	48,773
01/05/2014-31/04/2015	8,457	57,229	0	48,773
01/05/2015-31/04/2016	8,457	57,229	0	48,773
01/05/2016-31/04/2017	8,457	57,229	0	48,773

B.7. Application of the monitoring methodology and description of the monitoring plan:
B.7.1 Data and parameters monitored:

Data / Parameter:	EG _{v,net}
Data unit:	MWh
Description:	Net electricity exported to the national grid system from the project
Source of data to be used:	Receipts of sale of 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	91,816
Description of measurement methods and procedures to be applied:	<p>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:</p> <ul style="list-style-type: none"> • 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

CDM – Executive Board

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:	Surface area of the run-of-river reservoir
Data unit:	m 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:	Dak Srong 2 Basic Design Report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	5,037,000 m ² (5.037 km ²)
Description of measurement methods and procedures to be applied:	Identified in the FS and Recorded at the start of the project by a technical consultancy entity
QA/QC procedures to be applied:	Measured one time before the operation. Because the run-of-river reservoir of the project is a night-day regulating reservoir type. It uses a spillway dam or a weir, so when the reservoir is at the full water level, water will overflow the dam and the surface area of the reservoir can not exceed the full level.
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)	<ul style="list-style-type: none"> Ensure monthly meter readings are captured in standard format
Site Manager	<ul style="list-style-type: none"> Ensuring monthly monitoring takes place Initial check for anomalies (e.g. significant changes against previous readings or expected values) Site record management at the powerhouse

CDM – Executive Board

	<ul style="list-style-type: none"> • Communication of meter readings to a Director of the company • Attendance at annual verification
Director	<ul style="list-style-type: none"> • Collation of metered data from the project site • Collation of confirmation records from EVN purchasing subsidiary (see Annex 4) • Monthly cross-check of sales receipts against metered data

3. Metering System and Measurement Equipment

In general for every case, A Power Purchase Agreement (PPA) between the project developer and the EVN will define 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 Dak Srong 2 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.

4. 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 completion of first seven-year crediting period.
- Paper invoices will be collated by the Director and archived for at least two years after the completion of the crediting period.

5. Maintenance, Calibration and Accident Treatment for Measurement Devices

- The measurement devices will be initially and periodically calibrated by the authorities.
- The kiloWatt hour meters will be calibrated annually, whilst voltage and current transformers will 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.

CDM – Executive Board

6. 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 to the grid 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):

>>

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

Vietnam Representative Office
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:

As per the guidance of EB41 meeting report, the project activity started with the Project Proponent signing the construction contract for the project on the 25th January 2008.

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:

01/05/2010 or registration date, whichever is later

C.2.1.2. Length of the first crediting period:

7 years, May 1st 2010 – April 31st 2017

CDM – Executive Board

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

>>

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

The project will reduce the environmental impact associated with the production of electricity by substituting fossil fuels with water as a fuel supply. According to Vietnamese law, hydropower plants need to have their environmental impacts assessed with either an Environmental Impact Assessment (EIA), Environmental Impact Evaluation (EIE) or Environment Protection Commitment. The requirement as to which is required depends on the specific project (generally determined due to its reservoir size).

For the Dak Srong 2 project the reservoir volume is $85.6 \times 10^6 \text{ m}^3$ (exceeding 10^6 m^3 as required in Decree 80/2006/ND-CP), therefore it has undergone an Environmental Impact Assessment. This EIA has been approved by the relevant local authorities, Giai Lai Provincial People's Committee, dated 31st January 2008.

The environmental study has been conducted at the feasibility study stage. The EIA study concludes that for the project, negative environmental impacts are small because it is a run-of-river type. Moreover, it is situated in a remote area. Environmental impacts from the project have been clearly stated and approved by the local environmental authorities as described below.

Impact sources*Main pollution sources regarding the project activity*

- Land clearance
- Assembling fuel-materials, machines, equipments and workers
- Constructing access roads
- Land levelling and excavation
- Building the support areas
- Constructing main items: nodal sites, a energy route, a powerhouse and a tailrace.
- Reservoir bed cleaning
- Repairing, maintaining vehicles, machines, and equipment
- Maintaining and repairing during the operation phase
- Operative's activity

Table of pollution sources and waste types from project activities

CDM – Executive Board

No	Waste type	Pollution source
1	<i>Preparation and Construction phase</i>	
1.1	Air pollution <ul style="list-style-type: none"> • Dust • Exhaust gases: SO₂, NO_x, CO, VOC 	<ul style="list-style-type: none"> • Land clearance, excavation, smoothing activities and mining. • Operation of machines, equipment and vehicles • Material and fuel transport activities
1.2	Wastewater <ul style="list-style-type: none"> • Domestic wastewater • Industrial wastewater • Oil and degreaser 	<ul style="list-style-type: none"> • Workers' activities • Cement mixing means, car-cleaning places • Material and fuel stores, vehicle repair activities
1.3	Solid waste <ul style="list-style-type: none"> • Soil, stones and concrete • Iron, steel, wood pieces • Trees • Domestic solid waste 	<ul style="list-style-type: none"> • Material mining activities, leaking during the transportation • Steel rod processing activities and casing • Reservoir's bed and project layout cleaning activities • Worker's activities
2	<i>Operation phase</i>	
2.1	Oil, degrease and lubricant	<ul style="list-style-type: none"> • Repairing and maintaining activities; oil from transformers...
2.2	Domestic waste	<ul style="list-style-type: none"> • Operative's activities

Assessing the impacts of the project on the environment

- ***Solid waste***
This is mainly generated from worker's activities, which involves between 700-800 persons: around 144 tonnes/year. Components of domestic wastes:
 - ✓ Organic matters such as food leftovers, vegetable and fruits.
 - ✓ Inorganic matters such as plastic and glass
 - ✓ Metal items such as tin and aluminium cans.
- ***Wastewater: oil, degrease, lubricant: around 2,400 litres / year, domestic wastewater ~ 90 m³/day***
- ***Dust and exhaust gases:***
 - ✓ The rock volume needed to be excavated to construct the project is 500,000 m³ or 750,000 tonnes. The dust generated is projected at 300 tonnes, mainly from rock excavation activities. Sometimes and some cases, this dust amount will make dust concentration in the air up to 30-

CDM – Executive Board

40 mg/m³, exceeding the standard by around 80-100 times. Dust generated from other activities like earth excavation and filling works has a potential to cause air pollution ~ 500 kg/month. The affected areas are mainly access roads and construction sites (e.g. weir construction).

- ✓ Air pollution from transportation: air pollution load per month by this source is low, for dust ~0.42-5.25, SO₂ ~2.42-25.03, NO_x 1.46-68.83, VOCs 0.31-15.17. However, the project site is quite far from any residential area and the population density is low. Therefore, these impacts are negligible.
 - ✓ Noise and vibration come from digging and transport activities as well as from the operation of equipment and machines, but their impacts are considered small.
- *Impacts on ecosystems*
 - ✓ Impacts on flora: Some poorly established forest area without any precious species will be lost due to the project construction
 - ✓ Impacts on fauna: The project appearance can make habitation for many animals fragmented. The impacts are only temporary; it will be gradually recovered after the construction completion. And there are no valuable and threatened species on the area
 - ✓ Impacts on the aquatic systems: The impacts are not big; however the density of certain species might be reduced during the construction phase. When the construction is completed, it will promote the development of fishery.
 - *Impacts on Socio-Economic Environments*
 - ✓ Impacts on inhabitant's livelihood: Total land occupied is 544.6 ha of which agricultural land 87.8 ha, natural forest 155.6 ha, eucalyptus growing land 21.7 ha, unused land 90.5 ha, and others (river, stream) 189 ha. This affects 42 households with 261 persons.
 - ✓ Other negative impacts are small

- *Other impact sources*

Other impact include land erosion, landslide, subsidence, collapse, etc. River and reservoir' bank washout are not predicted to occur in the construction phase. When storing water in the reservoir, reservoir's bank could get washed out.. However, corrective actions can be taken by planting trees to enhance cover. Sedimentation only happens during the construction phase and the impact will be negligible as the river meanders 3 km after the construction site. In the reservoir, the expected sedimentation rate is small (~4% volume within 100 years). Besides this, the risk of fire and explosion also exists.

These above impacts identified are not considered as significant and are mainly temporary. Moreover, the project also creates many positive impacts such as: upgrading infrastructure, supplementing energy sources, promoting positive transformation of economic structure, positive impact on agricultural-tourism-fishery activities, etc. However, to reduce these negative impacts the project owner has proposed a number of measures. They are summarised as bellow:

CDM – Executive Board

No	Activities/ Impact sources	Main negative impacts	Mitigating measure
<i>I</i>	<i>Construction preparation & execution phase</i>		
1	Land clearance	<ul style="list-style-type: none"> - Loss of agricultural land and assets on the land; - Changing inhabitant's life 	Compensating and supporting consistently as required by the laws
2	Assembling machines, equipments and workers	<ul style="list-style-type: none"> - Causing environmental pollution due to waste, domestic wastewater 	<ul style="list-style-type: none"> - Placing car-parks - Building a waste collection and treatment system
3	Building and upgrading access roads	<ul style="list-style-type: none"> - Landscape changed - Polluting the environment by dust and exhaust gases 	<ul style="list-style-type: none"> - Design by qualified persons - Spraying water to limit dust
4	Land smoothing	<ul style="list-style-type: none"> - Loss of vegetation cover - Landscape changed 	<ul style="list-style-type: none"> - Reforesting after completing the construction
5	Land excavation and filling	<ul style="list-style-type: none"> - Losing land, changing topography and geomorphology of the area - Polluted by dust and exhaust gases - Increasing the likelihood of landslide and erosion of the construction site 	<ul style="list-style-type: none"> - Reforestation - Spraying water to limit dust - Wasted earth is compressed by earth movers - Collecting surface water
7	Building access roads	<ul style="list-style-type: none"> - Loss of land and landscape changed - Pollution to atmospheric environment by dust and exhaust gases 	<ul style="list-style-type: none"> - Spraying water to limit dust - At the end of construction phase, upgrading to make it into roads
8	Removing the cover of mines and exploiting construction materials	<ul style="list-style-type: none"> - Land loss, changing topography and geomorphology of the area - Causing air pollution by dust and exhaust gases - Increasing the likelihood of erosion and landslide 	<ul style="list-style-type: none"> - Spraying water to limit dust - Reforesting
9	Constructing main items including weir, spillway dam, water receiving gate, powerhouse, tailrace, electricity distribution stations (OPY)	<ul style="list-style-type: none"> - Land loss, changing topography and geomorphology of the area - Causing air pollution by dust and exhaust gases, noise - Increasing the likelihood of erosion and landslide - Likelihood of accidents 	<ul style="list-style-type: none"> - Spaying water - Using the advanced execution means - Strictly complying with safety regulations
10	Equipment and Fuel-material transportation	<ul style="list-style-type: none"> - Causing air pollution by dust and exhaust gases, noise 	<ul style="list-style-type: none"> - Spraying water - Using the advanced execution means
11	Reservoir's bed clearance and cleaning	<ul style="list-style-type: none"> - Loss of vegetation cover - Changing the landscape - Loss of habitats for some creatures 	<ul style="list-style-type: none"> - Clearing only the area necessary - Strictly prohibiting workers to hunt wild animals
12	Impoundment (river closure), creating a reservoir	<ul style="list-style-type: none"> - Loss of land - Changing the landscape of the area - Changing flow hydrological regimes on the river where the construction site is implemented 	<ul style="list-style-type: none"> - Selecting the suitable time to river closure (dry season or low flow season)

CDM – Executive Board

		- Changing habitats, living environments of aquatic organisms (water flowing-like creatures)	
13	Waste oil, degrease, lubricant etc including transformer's oil	- Polluting soil and water - Risk at fires - Dangerous to human' health and organisms	- Oil, degrease and lubricant including 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.

The project participants also make an emergency preparedness and response plan as follows:

Risk sources and a plan for them

- ✓ Fire and explosion in the fuel tanks and mine- explosive stores – The fuel tanks and explosive stores will be located far from residential areas, designed as required by relative standards and safety code of the state, and workers provided with appropriate equipment. Training workers to comply with regulations and know how to responds to accidents
- ✓ Accidents regarding mines, and other explosive items leftover from the Vietnam War - the project owners will hire a functional unit to survey the area before implementing any activities Cutting trees, forest fires and animal hunting – strictly prohibited as well as educating workers not to hunt and catch wild animals.
- ✓ Other risks regarding natural hazards - a board will be set up to deal with other risks
- ✓ Accidents of weir collapse (*very unlikely*) or landsides – reforestation, enhancing to check the area.

In addition, the project owner also commits to an environmental monitoring plan and strictly comply with all related Vietnamese laws.

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 Gia Lai Provincial People's Committee on January 31st 2008.

SECTION E. Stakeholders' comments

>>

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

CDM – Executive Board

The stakeholder consultation meeting was held at the Administrative Building of Kong Ch'ro District People's Committee, Gia Lai Province, Vietnam at 0900hrs on 28/07/2008. Personal invitations were sent to community leaders, local People's Committee representatives and placed in the media. Public notices of the planned consultations were placed in *National Resources and Environmental Newspaper* which is widely published and read in the 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 20 participants attending the meeting.

Figure E.1 Picture of the stakeholder meeting in the project site in 28/07/2008



E.2. Summary of the comments received:

Looking at the above summary table, the stakeholders have not identified any major negative impact of the project. Local stakeholders appreciated and expressed that the project will have many positive aspects regarding a job creation.

- 100% participants identified that there are no negative impacts from the projects;
- 100% attendees agreed that the project will create jobs for them;

CDM – Executive Board

- 100% attendees also stated that the project will not lead to any changes to existing land-use. In fact, the projects (there is a second planned project, Dak Srong 2a) occupy some 700 hectares in total for construction of the project. It will affect some of the participants; but the project owner has committed to consistently compensate and attendees were happy with that assurance.

In general, the project has many positive responses from local communities. They are also expecting positive impacts on social, economic and environmental aspects of the project. Moreover, all concerns about environmental aspects have already 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 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% of CER revenue by the project developers to sustainable development and cultural aspects such as:

- Building and improving infrastructure of the locality such as schools or healthcare centres etc.
- Sponsoring social activities of the local communities such as cultural or sports events etc.

Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Hoang Anh Gia Lai Hydropower Joint Stock Company
Street/P.O.Box:	Suite 3 - Floor11 - Hoàng Anh Gia Lai Hotel
Building:	No 1, Phu Dong Street
City:	Pleiku City
State/Region:	Gia Lai Province
Postfix/ZIP:	
Country:	Vietnam
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	Mr Nguyen Van Hung
Title:	Director
Salutation:	
Last Name:	Nguyen
Middle Name:	Van
First Name:	Hung
Department:	Hoang Anh Gia Lai Hydropower Joint Stock Company
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

CDM – Executive Board

Organization:	Bunge Emissions Holdings Sarl
Street/P.O.Box:	c/o Bunge SA, 13 Route de Florissant, P.O. Box 518
Building:	
City:	Geneva
State/Region:	Geneva 12
Postfix/ZIP:	1211
Country:	Switzerland
Telephone:	+41 22 59 29 621
FAX:	+41 22 580 3360
E-Mail:	Emissions@bunge.com
URL:	
Represented by:	Francois Gigante
Title:	Head of Project Investment
Salutation:	Mr.
Last Name:	Gigante
Middle Name:	Louis
First Name:	Francois
Department:	
Mobile:	
Direct FAX:	+41 22 580 3360
Direct tel:	+41 22 59 29 655
Personal E-Mail:	Francois.gigante@bunge.com



CDM – Executive Board

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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



CDM – Executive Board

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	tCO ₂ / MWh
		TJ	tCO ₂ /TJ	tCO ₂ (= 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



CDM – Executive Board

Build Margin		A	B	C	D	E
	Commercial Operation Date	Fuel Consumption 2007	Emission Factor	Emissions	Generation (2007)	Emissions Rate
	Year	TJ	tCO ₂ /TJ	tCO ₂ /y	GWh	tCO ₂ / MWh
				tCO ₂ (= 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	tCO ₂ /MWh	0.697735
B	Estimated build margin emission rate	tCO ₂ /MWh	0.548872
C	Estimated baseline emission rate*	tCO ₂ /MWh	0.623304

**Annex 4****MONITORING INFORMATION**

Power purchasing company name: Electricity of Vietnam (EVN)

Connection point details: The electricity generated from Dak Srong 2 hydropower plant will be connected to the National Grid through a new 110 kV single circuit transmission line from 110 kV Transformer Station of the Dak Srong 2 to 110 kV transformer station of the Dak Srong 2 A hydropower plant and then connect through the 110 kV transformer station of Dak Srong hydropower plant to the National Grid.

Project Manager Name: Mr Nguyen Van Hung, Director of the company

Site Manager Name: Mr Nguyen Le Anh Duy, Person in charge of the project