



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

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

Project title: Dak Psi 3 and 4 Hydropower Project.
Version 4.1: Prepared for for post registration correction
Completion date: 19/11/2012

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

The Dak Psi 3 and 4 hydropower project is being developed by Dak Psi Hydropower Investment and Development Joint Stock Company of Viet Nam. The proposed project activity aims to construct and operate a run-of-river hydropower project with 2 cascades namely Dak Psi 3 and Dak Psi 4. Dak Psi 3 cascade will be situated in Dak Psi commune, Dak Ha district, and Dak Psi 4 cascade- in Dak Ha commune, Tu Mo Rong district, Kon Tum. Kon Tum Province is located in the Centre of the country, which is one of the poorest areas in Viet Nam¹. The proposed project utilises water resources of the Dak Psi River, which runs into the Krong Poko River.

The project will be built in two phases. The first phase, which corresponds to Dak Psi 4, plans to start operation in January 2011. The second phase is expected to be operational 2 years later.

The project, with a total installed capacity of 45 MW, will generate approximately 170,755 MWh/pa of power to the national grid by using water turbines, resulting in estimated emission reductions of 64,576 tCO₂/pa during the first two years and 98,423 tCO₂/pa during the next five years of the first seven year crediting period. This will offset the combustion of thousands of tonnes of fossil fuels, which would have been used to generate electricity for the Viet Nam electricity grid. In doing so, this project will help preserve non-renewable resources by promoting the exploitation and use of renewable resources.

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. However, based on economic-financial analysis the project is financially unattractive. Therefore, the support of the CDM is imperative if the project is to be executed and emission reductions realised. Moreover, this is a project good for sustainable development and the environment. The project has positive impacts with respect to the environment (offsetting fossil fuel use and lowering greenhouse gas emissions), society (providing jobs, development of infrastructure), technology (technology transfer) and economy (satisfying growing energy demands to allow the country and region to develop). Further, in order to meet the growing

¹ The district has been classified as special economic difficulties in Decree No. 124/2008/ND-CP dated 11/12/2008



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demand for electricity as the country develops, Viet Nam imports electricity from China. The implementation of the proposed project will offset this need which will bring environmental benefits as China has an electricity grid emission factor almost 50% higher than that of Viet Nam, and help with Viet Nam's balance of payments.

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 Viet Nam (host)	<u>Private Entity:</u> Dak Psi Hydropower Investment and Development Joint Stock Company (as the project owner)	No
Switzerland	<u>Private Entity:</u> Vitol S.A.	No

Dak Psi Hydropower Investment and Development J.S.C: a company set up mainly for development of power projects, based in Pleiku City, Gia Lai Province, Viet Nam.

Vitol S.A.: is one of the largest traders in the world's energy marketplace. They are a major supplier of petroleum to Viet Nam's state-owned PetroViet.

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 Viet Nam

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

Kon Tum Province

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

Dak Ha and Tu Mo Rong Districts



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

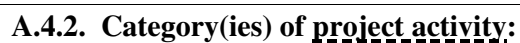
The proposed project is situated on Dak Psi River. The Dak Psi River is a branch of the Krong Ko Po river, which is the main tributary of Se San river running Northwest-Southeast then flowing into Mekong river. The terrain of the river's watershed is mainly a mountainous area and high land. The nearest city to the project site is Kon Tum (~100 km). Figure A1 shows the location of the project. The co-ordinates of the site are latitude of 14°46'30"N and longitude of 107°59'50"E.

Figure A1. Project location:

Project location on Viet Nam Map



Project location on Kon Tum Map

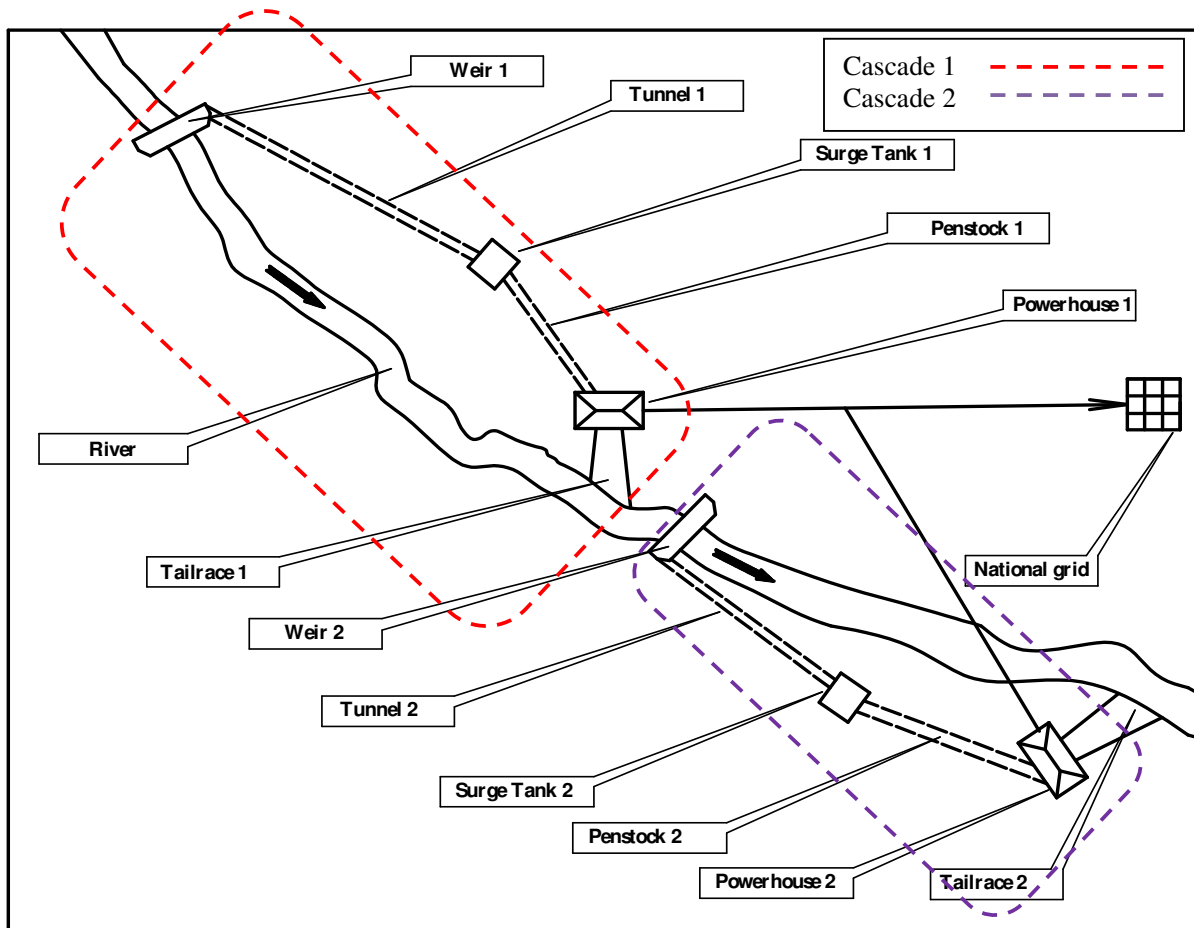


Sectoral Scope 1: Energy industries (renewable/non renewable sources)

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 and spillway dam, a penstock, a powerhouse (containing turbines and generators) and a tailrace as shown in Fig. A2. The installed capacity of the project is 45 MW and total expected annual net generation is 170,755 MWh. The main items of equipment such as turbines, generators, and governors will be imported from China. This will contribute to the transfer of technology to Viet Nam. The electricity generated by the project will be delivered to the Viet Nam national grid via a new 110 kV transmission line.

Fig. A2. A schematic representation of the proposed project activity



The technology of the project is detailed in the Table A.1. 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. This is in addition to the fact that power is generated by a renewable resource resulting in zero emissions.

Table A1. The main technologies used in the project, imported from China.

Dak Psi 3 cascade		Value
TURBINE	Model	Francis Turbine- horizontal axis
	Quantity	3
	Capacity	5.208 MW
	Rate speed	500 rpm
	Runaway speed	946 rpm
	Efficiency	88.62%
GENERATOR	Model	3 phase synchronization with horizontal axis
	Quantity	3
	Capacity	5 MW
	Rated speed	500 rpm
	Runaway speed	946 rpm
	Cosφ	0.8
	Efficiency	96.00%

Dak Psi 4 cascade		Value
TURBINE	Model	Francis Turbine, horizontal axis
	Quantity	3
	Capacity	10.3093 MW
	Rated Speed	500 rpm
	Runway Speed	1234 rpm
	Efficiency	91%
GENERATOR	Model	3 phase synchronization with horizontal axis
	Quantity	3
	Capacity	10 MW
	Rated speed	500 rpm
	Runaway speed	1234 rpm
	Cosφ	0.8
	Efficiency	97%

**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 98,423 tCO₂e after the two cascades are finished, as shown in Table A.2. The project will employ a renewable crediting period and the total emission reductions are estimated to be 621,267tCO₂e for the first seven year crediting period.

Table A. 2. 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
01/07/2011-30/06/2012	64,576
01/07/2012-30/06/2013	64,576
01/07/2013-30/06/2014	98,423
01/07/2014-30/06/2015	98,423
01/07/2015-30/06/2016	98,423
01/07/2016-30/06/2017	98,423
01/07/2017-30/06/2018	98,423
Total estimated reductions (tCO₂e)	621,267
Total number of initial crediting years	7
Annual average of the estimated reductions over the crediting period	88,752

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 12.1.0.

As the project's total installed capacity is 45MW (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 05.2)
- Tool to calculate the emission factor of an electricity system (Version 1.1)

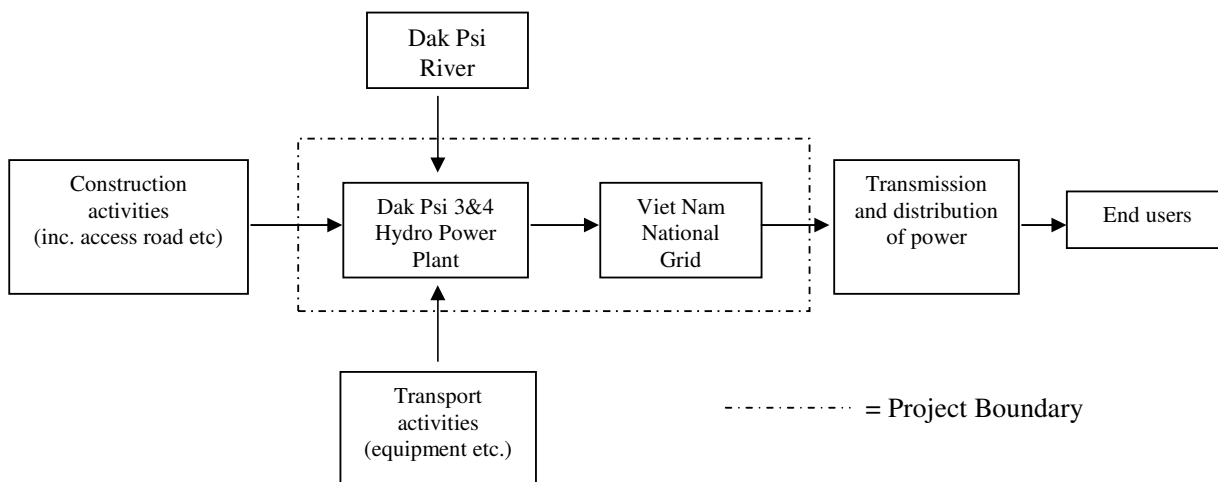
B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

	Applicability Criteria	Project Activity
1	The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following type: 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 run-of-river reservoirs.
2	The project activity results in a new reservoir and the power density of the power plant, as per definitions given in the Project Emissions section of ACM 0002, is greater than 4 W/m ² .	The project activity has a power density in excess of 94.74 W/m ²
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 Viet Nam national grid system. As per the guidance set out in ACM0002, the project boundary includes the project power plant and all power plants connected physically to the electricity system. In the case of this project the electricity system is the Viet Nam national grid system, which is comprised of a range of thermal, gas, diesel oil and hydropower plants (please see section B.4.). This is represented diagrammatically in Fig. B1.

Figure B1. The project boundary



As per ACM0002, 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	CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	
Project activities	For hydro power plants, emissions of CH ₄ from the reservoir.	CO ₂	No	Minor emission source
		CH ₄	Yes	Main emission source
		N ₂ O	No	Minor emission source

**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 Viet Nam (EVN) dominates power production, transmission, and sale in Viet Nam. 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 2002-2008, total power generation increased from 45,974 GWh in the year 2002, to 74,690 GWh in 2008 and the contribution of hydropower decreased from 39.71% to 34.72% in the same period².

The need for projects such as Dak Psi 3 and 4 is clearly illustrated by the fact that the contribution of hydropower and renewables to the overall supply of electricity in Viet Nam is shrinking and not growing. Currently, due to shortfalls in the amount of electricity available, Viet Nam imports electricity from China, where the grid emission factor is higher than that of Viet Nam.

Data Used to Determine Baseline Emissions

It should be noted from the outset that published data for the electricity system in Viet Nam is published on a very infrequent basis in the form of Masterplans for Electricity Production, the latest being used in this PDD³. Occasionally, interim reports are also released and where possible, this more up to date data is used. However in some cases data from the latest Masterplan is the only official source of data available

The baseline emission factor used in this project for the grid was based on the report published by the Vietnamese DNA - “Study, Definition of Vietnam Grid Emission Factor prepared by the Department of

² GEF report from DNA

³ EVN Masterplan for Electricity Production 2006-2015, Outlook to 2025



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Meteorology, Hydrology and Climate Change”⁴. The report was completed in December 2009, but was only made available by the DNA in 2010.

The data is:

- The latest source of data which is also publically available;
- Its results are published in a transparent manner; and
- The calculations are carried out in a conservative manner

Table B.2 shows the parameters required to calculate the emissions of the power plants that serve the national grid system.

Table B.2: Data used to determine baseline emissions

Parameter	Detail	Source
$EF_{grid,OM,y}$	Operating margin CO ₂ emission factor for grid connected power generation in year y.	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
$EF_{grid,BM,y}$	Build margin CO ₂ emission factor for grid connected power generation in year y.	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit <i>m</i> in year y (MWh)	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
$EF_{EL,m,y}$	CO ₂ emission factor of power unit <i>m</i> in year y (tCO ₂ /MWh)	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
<i>m</i>	All power units serving the grid in year y except low-cost / must-run power units	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
<i>y</i>	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (<i>ex ante</i> option)	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change

⁴ http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_vnHe%20so%20phat%20thai.pdf (last accessed on 12/09/2010)



$FC_{i,m,y}$	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change
$EF_{CO_2,i,y}$	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)	Study, Definition of Vietnam Grid Emission Factor prepared by the Department of Meteorology, Hydrology and Climate Change

In the report referenced, the operating margin is derived through a combination of using Simple OM methodology, as it is demonstrated that low cost / must run power stations contribute less than 50% of total power generation between 2004 and 2008. For build margin, option 1 is employed whereby build margin is defined as the generation weighted average of the most recently built power plants which contribute 20% of total power generation. This is detailed in section B.6 and annex 3.

Following the end of the first crediting period, it is anticipated at this stage that a new ex-ante calculation of emission factor will be performed based on the latest data available from the Vietnamese DNA.

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, Version 05.2”, 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 alternatives is presented below:

- Scenario (a) is, prior to conducting an investment analysis, a realistic and credible alternative.
- Scenario (b) is neither realistic nor credible because, with respect to energy, the Dak Psi Hydropower Investment and Development J.S.C only has experience in hydropower project development and therefore a coal fired power station or wind farm is not an option. Besides, solar and wind power projects are of very small scale and are rare in Viet Nam. 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.
- Scenario (c), which is a continuation of the current situation (no project activity or other alternatives undertaken) with electricity provided from the Viet Nam 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 alternatives to the project are alternatives (a) and (c) – both of which are in compliance with all Viet Nam legal and regulatory requirements.

Step 2: Investment Analysis

Sub-step 2a: Determine Appropriate Analysis Method

It is chosen to demonstrate that the project activity is not “Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).”⁵ The tool 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

⁵ The Tool for the Demonstration and Assessment of Additionality, version 5.2, Step 2



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 may 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 Viet Nam at the time the decision making. The three year weighted average prime lending rate preceding the decision to go ahead with the project was used with the legally mandated mark up⁶ to arrive at the commercial lending rate of 12.28%. It is:

- The lending rate of commercial banks is based on the State Bank of Viet Nam 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 chosen, therefore, fulfils all the criteria laid down by the Additionality Tool⁷ 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).

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

The following input parameters (Table B.3) were considered in making the projected income statement and IRR computation:

⁶ State Bank of Viet Nam and Vietnamese civil law codes

⁷ And also the *Guidance on the Assessment of Investment Analysis*, Point No.11 (page No.3)



Table B.3: Key input parameters

Parameters	Value	Basis
Installed capacity (MW)	45	Feasibility study
Plant load factor, cascade 1 (%)	45.60	Computed
Plant load factor, cascade 2 (%)	43.50	
Annual power supplied to the grid, cascade 1 (MWh)	58,722	Computed
Annual power supplied to the grid, cascade 2 (MWh)	112,034	
Auxiliary consumption (as percent of generation)	2	General norm, transmission and distribution losses
Total Investment (Billion VND)	1,142.63	Feasibility study
Loan: equity ratio	70:30	Feasibility study
Power tariff (Dong/ kWh)	710.4	Feasibility study
O&M cost (as percent of project cost)	0.5	Decision 2014/QD-BCN
Insurance (as percent of project cost)	0.25	Decision 33/2004/QD-BTC
Interest rate on term loan (%): - Commercial bank	12.28	Local commercial lending rate
Loan repayment period (years)	10	Feasibility study
Initial moratorium period (years)	4	Feasibility study
Depreciation – Equipment (per cent)	5	Present practice in Viet Nam, Decision 203/2009/TT-BTC
-Civil works (per cent)	10	Present practice in Viet Nam, Decision 203/2009/TT-BTC
Natural Resource Tax (as percent of revenue)	2	Ordinance on Natural Resource Tax and Decision 16/2008/QD-BTC
Enterprise Income Tax (per cent)	0-25	Law No 14/2008/QH12 dated 03/6/2008 and Decree No.124/2008/ND-CP dated 11/12/2008.

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. 124/2008/ND-CP dated 11/12/2008. Moreover, the project activity is located in an area of *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. Although the IRR has been computed for a period of 30 years and the entire assets are fully depreciated⁸, a salvage value has been taken at 5% of the total equipment and construction cost of the project in the terminal year (this is conservative as although assets are fully depreciated, the equipment may have some scrap metal value). Based on the above, the project IRR works out to 8.14% (8.85% if income tax excluded is excluded) as against the benchmark return of 12.28%.

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	8.14%	12.28%

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 not been mentioned as against the inflation rate of over 25%⁹ in 2008 and around 8% in the first half of 2009 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). Four factors have been identified as sensitive, viz., project cost, PLF and O&M cost and tariff. 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 four parameters on the project IRR have been worked out and the results are as follows:

⁸ Including the additional investment provided in the 16 the year as permitted by the Guidance on the Assessment of Investment Analysis (item No.1)

⁹ <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>



Table B.5: Sensitivity Analysis

Project IRR	-10%	0	10%
PLF	6.94%	8.14%	9.31%
Project cost	9.41%	8.14%	7.07%
O&M cost	8.19%	8.14%	8.10%
Tariff	6.94%	8.14%	9.31%
Benchmark	12.28%		

The above analysis calls for some explanation. It needs to be mentioned that the PLF is based on the hydrological study and the most optimistic scenario is usually considered while preparing the income statement. Since it is dependent upon historical climatic records, 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 5 basis points when the O&M cost is brought down by 10%. It should also be noted that the project is still additional under all sensitivity tests if income tax is removed.

Reduction in project cost is also highly unlikely as the country hits the highest inflation within a decade. Inflation rate has touched 15.7% in February 2008¹⁰ 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 (whether the project IRR is considered with or without income tax). 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 13.27%. It is with respect to the above background that CDM registration is requested.

Step 3: Barrier Analysis

As the Additionality of this project is demonstrated through an investment analysis, this optional step is skipped.

¹⁰ <http://www.iht.com/articles/ap/2008/02/28/business/AS-FIN-ECO-Vietnam-Inflation.php>, downloaded on August. 15, 2008

**Step 4: Common practice analysis*****Sub-step 4a: Analyse Other Activities Similar to the Proposed Project Activity:***

Setting up of hydro power projects of 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, this is most important in a country such as Vietnam where contacts and government connections are key. Based upon an exhaustive research on hydropower projects in Viet Nam, a list of 109 hydropower plants were identified for consideration in the common practice analysis and supplied to the DOE (those seeking CDM registration or not yet started construction were not included in the comparison with the proposed project). This comprehensive list of the identified power plants in Viet Nam includes details of hydro power plants presently in operation¹¹, those that have permission granted to build power plants from 2006-2008¹² and includes both government involved as well as private plants¹³.

It is submitted that at the time of writing, this PDD used the most comprehensive list of power plants in Viet Nam as it details both Government owned plants and Independent Power Producers (IPPs). This is confirmed by letter from a senior official at the Ozone Layer Protection Centre (an institute under the Viet Nam Ministry of Natural Resources and Environment) which has been previously supplied to the DOE.

The results of this common practice analysis study (based on the list of plants described above) have been furnished to the DOE and were initially categorised into those which are privately owned and those that benefit from some kind of state involvement. Examples of the latter may be power plants which are wholly owned by the EVN, are state owned IPPs or have the EVN as a shareholder / equity investor. The UNFCCC's own definition of "large" and "small" (+/- 15MW) scale was used to decide whether projects were of the same scale.

It can be seen from the study that:

- The 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 (96 or 88% of the 109 projects listed).
- Of the hydro plants which are state involved, the clear majority are over 15MW (76 or 79% of the government projects identified).
- Of the plants remaining, there are few that are considered privately owned (13 or 12% of identified projects) and fewer still would cross the CDM large scale / small scale

¹¹ <http://www.industcards.com/hydro-vietnam.htm>, downloaded on August 14, 2008

¹² EVN Masterplan for Electricity production 2005-2015

¹³ 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>



threshold of 15MW generation capacity as this project does (only 1 project) and therefore be considered comparable.

NB: Some plants in the dataset used for the analysis from the PDD published for global stakeholder consultation were removed as there were found to be double entries (e.g. “Tra Xom” and “Tra Som” or “Eakrong Rou” and “Eak Rong Rou”) owing to using more than one data source using different translations into English. Further, some projects previously listed as SOEs were listed for GSC and hence not required to be part of the analysis as per the additionality tool. It should be highlighted that the re-classification of plants or removal of duplicate records makes no difference to the result of the common practice analysis study as only two projects previously considered “similar” were reclassified as CDM projects.

Following is a discussion on the distinction between wholly EVN owned plants, State Owned Enterprises (SOEs) and privately developed projects.

The fact that setting up of hydro power plants such as this project by the private sector is not a common practice places the project at a disadvantage with respect to those developed solely by the EVN or SOEs. The involvement of state owned companies in a country like Viet Nam helps those other projects significantly. The key difference between state owned enterprises (SOEs) and privately owned projects such as the proposed project is financial and can be summarised as follows:

1. Wholly government owned projects (i.e. EVN developed) draw funds from the state budget for project development and are not subject to either commercial targets (e.g. shareholder profit) or bank loan covenants (e.g. debt service coverage ratio).
2. Privately developed projects must legally contribute 30% of the equity of a project in order to receive a bank loan. In the case of SOEs, the equity stake can be lower (e.g. 15% equity¹⁴) and hence not such a barrier to proceeding with a project.
3. SOEs benefit from state guarantees to the lending banks and preferential interest rates¹⁵. In addition, all domestic banks in Viet Nam are also SOEs.

There are also a number of non-financial reasons why SOEs have advantages over private developers. These can be summarised as follows:

1. The proposed project is not funded using non-recourse project finance. Therefore the project proponent must provide collateral for a commercial loan whereas an SOE can receive a government guarantee.
2. Being such a socialistic country, land in Viet Nam is only owned by the State. Therefore independent project developers must go through land and water use application processes which are costly and time consuming. SOEs do not have this burden.

¹⁴ <http://www.themalaysianinsider.com/business/article/china-eximbank-lends-us300m-to-vietnam-power-plant/>

¹⁵ <http://www.adb.org/Documents/Reports/PSA/VIE/VIE-PSA.pdf> p4



3. Access to skilled workforce. In “A study on project success factors in large construction projects in Viet Nam (2004)” by Nguyen et al, the authors conclude that the top three critical success factors for developing projects of this kind are (in order):
 - i. Competent project manager;
 - ii. Adequate funding;
 - iii. Multi-disciplinary / competent project team.

The state is much more likely to be an employer in a country such as Viet Nam than another comparably sized economy due to its Socialist nature and high levels of state ownership (as evidenced by the figures below, the state does own or have a stake in 88%¹⁶ of the hydroelectric projects that are not seeking CDM sponsorship in Viet Nam).

A further examination of the statistics reveals the following:

- The vast 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 (96 or 88% of projects in the data set).
- Of those 96 projects, 76 (76%) are 15MW or over; i.e. are comparable with this project in that they would be considered large scale CDM projects. This shows that the state dominates the development of large scale hydroelectric power plants).

Sub-step 4b: Discuss any Similar Options that are Occurring:

As noted above, the PDD initially published for the global stakeholder consultation provided seven (7) projects which were [initially] considered [similar]. Four were found to be not yet operational at the time of global stakeholder consultation, one was found to be a small scale hydroelectric CDM project, and the last was in fact found to be a large scale CDM wind power project).

The result is that there is found to be only one hydropower station that was not wholly built by the State, an SOE or private Vietnamese company that is comparable to the proposed project.

This plant is not found to be not “similar” to this project in that the plant, Suoi Vang, was built in 1943¹⁷ by the French colonialist Governor General Jean Decoux during the French colonisation of Viet Nam during this time in the 1940s. Its development therefore pre-dates the formation of the EVN and therefore in a non-comparable socioeconomic environment.

From the above statistics and analysis, it is seen that there are no plants of the capacity of this project developed without CDM in Viet Nam since the last National Development Power Plan,

¹⁶ Please refer to sub-step 4a

¹⁷ <http://vietnamnews.vnagency.com.vn/Domestic-Press-Highlights/154982/Nations-oldest-hydropower-plant-gets-facelift.html>



and this is mainly due to extreme macroeconomic conditions experienced in Viet Nam in the last few years and ongoing today. At the time of writing and according to the Ho Chi Minh City Union of Business Associations interest payable in Viet Nam is currently a stifling 18-19% and is causing local enterprise to “dare not take out loans from banks”.¹⁸

It can also be seen from the study that a vast majority of the hydropower projects which may be classified as large, are developed with state involvement (discussed further below). The instances in which private developers undertake this kind of activity are also seen to be quite limited. Indeed, as it is demonstrated that only 1 from 109 plants are open to comparison with this project (over 15MW capacity and privately owned) it is submitted that construction of hydropower plants of this scale by private corporations is not a common practice in Vietnam.

It should be noted that in the interest of conservatism when carrying out the study, for those plants for which no information could be publically found (the market is not transparent), it has been assumed that they are privately owned. In fact therefore, the figures above could further demonstrate that projects such as this one are not common practice.

A further note with respect to carrying out the study, with respect to size categorisation:

In the approach to common practice analysis taken in this PDD, projects have been categorised as large or small scale depending on whether above or below 15MW (the CDM definition). In Viet Nam, Government [Decree No. 124/2008/ND-CP](#) states that projects lower than 30MW are “small scale”. Therefore this approach is considered conservative as the dataset of “large scale” projects includes projects from 15MW and above, not just 30MW and above.

This demonstrates that the common practice is in fact the development of large scale hydropower by the state, and not by private enterprise.

Prior Consideration of the CDM

The CDM benefit was identified by the Board of Directors of the Dak Psi hydropower project as imperative to make the project financially attractive. A resolution to this effect was passed by the Board of Directors on 14th April 2008. After the Board accorded approval, a contract was signed with a CDM consultant on 28th October 2008. Correspondence and contracts relating to this would be furnished to the DOE. The project started with the Project Proponent signing the construction contract on 27th April 2008.

¹⁸ <http://vietnambusiness.asia/high-interest-rates-impede-enterprises-expansion-plans/>



This represented in tabular form below:

Action	Date	Source
Discussions with CDM consultants	01/03/2008	Meetings
EIA approval obtained	18/03/2008	Company Document
Board of Directors meeting to decide to proceed with Dak Psi project as CDM revenue makes project feasible	14/04/2008	Board Resolution
First contract for civil construction signed*	27/04/2008	Main construction contract
Contract for CDM signed with CDM consultant	28/10/2008	Carbon Asset Management agreement
Contract for Emissions Reductions Purchase	14/05/2010	Emission Reductions Purchase Agreement
Commercial operation date for first phase (anticipated)	01/01/2011	Project manager interview

*Taken as project start date

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 12.1.0 are used in conjunction with the “Tool to calculate the emission factor for an electricity system (Version 1.1, the latest available version at the time the calculation was made)” including the following steps:

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

The following steps are as per the Study, Definition of the Grid Emission of Vietnam prepared by the Department of Meteorology, Hydrology and Climate Change,¹⁹ referenced previously in Section B4 (source of baseline data).

1. Baseline Emissions

Step 1: Identify the Relevant Electric Power System

¹⁹ http://www.noccop.org.vn/Data/vbpq/Airvariable_idoc_vnHe%20so%20phat%20thai.pdf (last accessed on 12/09/2010)



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 Viet Nam 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.”

As per the study the contribution of “low cost” and “must run” sources to overall power generation in Viet Nam is well below 50% (please refer to table B.8). 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.8. Contribution of low cost and “must run” sources to overall power generation in Viet Nam²⁰

Year	2004	2005	2006	2007	2008	Average
Percentage share of low cost and “must run” power stations	39.71	32.52	34.13	33.74	34.72	34.77

The ex-ante option has been chosen for this project. 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

As per the study, Option A 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:

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

²⁰ Source: GEF from the Department of Meteorology, Hydrology and Climate Change (table 2)



(1)

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

(2)

Where:

- $EF_{grid,OMsimple,y}$ = Simple operating margin. 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)
 $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
 $EF_{CO2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂/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

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

Where:

- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
 $EF_{CO2,m,i,y}$ = Average CO₂ emission factor of fuel type i used in power unit m in year y (tCO₂/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)

Viet Nam currently imports electricity from China to make up for the shortfall in supply from its own generation system. Whilst the emission factor of China's grid is higher than that of Viet Nam's, as a conservative approach, this PDD has considered these imports as zero emissions whilst taking into account their contribution to the overall power generation of Viet Nam.

Step 4. Identify the group 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 2008 than the five most recently built power stations. As such, the weighted carbon emissions from the former were used to calculate the build margin. Option (b) is chosen in the first step.

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 (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 option B1 B2 and B3, 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 7. 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 weights 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.

Calculate of the Baseline Emission (BE_y)

The baseline emissions (BE_y in tCO₂e) are given by:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (6)$$

Where:

- BE_y = Baseline emissions in year y (tCO₂/yr)
 $EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
 $EF_{grid,CM,y}$ = Combined margin CO₂ emission factor for the grid connected power generating in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO₂/MWh)

2. Project Emissions

The Dak Psi 3,4 Hydropower Project has a total installed capacity of 45 MW (or 45,000,000 W) and its run-of-river reservoir has a surface area of 0.475 km² (475,000m²). 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 Psi 3,4 Hydropower Project are therefore:

$$PD = 45,000,000 \text{ (W)} / 475,000 \text{ (m}^2\text{)} = 94.74 \text{ W/m}^2$$



The power densities of the two cascades are also calculated separately below to illustrate that even considered separately, each value is high enough to render the emissions 0.

For Cascade 1:

$$PD_1 = 15,000,000 \text{ (W)} / 207,000 \text{ (m}^2\text{)} = 72 \text{ W/m}^2$$

For Cascade 2:

$$PD_2 = 30,000,000 \text{ (W)} / 268,000 \text{ (m}^2\text{)} = 112 \text{ W/m}^2$$

Because the power density of the project (whether calculated for both cascades together, or for each separately) is greater than 10 W/m^2 , the project emissions are given by:

$$PE_{HP,y} = 0$$

3. Leakage

As per methodology ACM0002, version 12.1.0, the project owner does not need consider leakage.

Therefore:

$$LE_y = 0 \quad (8)$$

4. Emission Reductions

Emission reductions are calculated as follows

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

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) [equivalent to $PE_{HP,y}$ for hydro power plants]

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

Data / Parameter:	EF_{grid,CM,y}
Data unit:	tCO ₂ /MWh
Description:	Combined margin CO ₂ emission factor for grid connected power generation
Source of data used:	As per the “Tool to calculate the emission factor for an electricity system” and



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	Combined Margin defined in issued “Study, Definition of Viet Nam Grid Emission Factor, 2009” ²¹ by the Department of Meteorology, Hydrology and Climate and issued by DNA
Value applied:	0.5764 tCO ₂ /MWh
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated as per “Tool to calculate the emission factor of an electricity system”
Any comment:	-

Data / Parameter:	EF_{Res}
Data unit:	kgCO ₂ e/MWh
Description:	Default emission factor for emissions from reservoirs
Source of data:	Decision by EB23
Value applied:	90 kgCO ₂ e/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per ACM0002.
Any comment:	-

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is a new hydro power plant.
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m ²
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m ²). For new reservoirs, this value is zero
Source of data used:	Project site

²¹ Study, Definition of Viet Nam Grid Emission Factor, 2009 by the Department of Meteorology, Hydrology and Climate



Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:)	The project has new reservoirs.
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 are 112,034/pa for first two years and 170,755MWh/pa from 3rd year onward. 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:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (6)$$

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

For first two years:

$$ER_y = (112,034 \times 0.5764) = 64,576 \text{ tCO}_2\text{e}$$

For next years:

$$ER_y = (170,755 \times 0.5764) = 98,423 \text{ tCO}_2\text{e}$$

Thus the annual emission reductions attributable to the full proposed project activity are 98,423 tCO₂e.

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)



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01/07/2011-30/06/2012	0	64,576	0	64,576
01/07/2012-30/06/2013	0	64,576	0	64,576
01/07/2013-30/06/2014	0	98,423	0	98,423
01/07/2014-30/06/2015	0	98,423	0	98,423
01/07/2015-30/06/2016	0	98,423	0	98,423
01/07/2016-30/06/2017	0	98,423	0	98,423
01/07/2017-30/06/2018	0	98,423	0	98,423

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

Data / Parameter:	$EG_{\text{facility},y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating the expected emission reductions in section B.5	112,034 (first two years) 170,755 (year three onwards)
Description of measurement methods and procedures to be applied:	Bi-directional electricity meters to account for both export and import to arrive at net electricity Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity
Any comment:	-

Data / Parameter:	Cap_{PI}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the



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	project activity
Source of data to be used:	Project site
Value of data applied for the purpose of calculating the expected emission reductions in section B.5	45,000,000 (15,000,000 and 30,000,000 for Cascade 1 and 2 respectively)
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards Yearly measurement
QA/QC procedures to be applied:	-

Data / Parameter:	A_{PJ}
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:	Project site
Value of data applied for the purpose of calculating the expected emission reductions in section B.5	475,000 (207,000 and 268,000 for Cascade 1 and 2 respectively)
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc Yearly measurement
QA/QC procedures to be applied:	-

B.7.2. Description of the monitoring plan:

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A final monitoring plan will be prepared prior the start crediting date based on the as-built project activity. The following indicative plan is provided in the meantime. It will address the following aspects:

1. The **CDM monitoring team** and allocation of responsibility to ensure compliance with the monitoring requirement of the methodology is given here below:

Position	Responsibilities
Operational staff	Ensure meter readings are captured in standard format
Site Supervisor	- Ensuring 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 Project Director - Attendance at annual verification
Project Director	- Collation of metered data from the project site - Collation of confirmation records from the power purchaser (see Annex 4) - Monthly cross-check of confirmation records against metered data

	Tasks description	Operator	Supervisor	Project director	CDM Consultant
<u>Monitoring activity</u>					
1	Recording of monitored data	✓			
<u>Quality Assurance & Quality Control</u>					
2	Verification of data monitored (consistency and completeness)		✓		
3	Ensuring adequate training of staff		✓		
4	Ensuring adequate maintenance		✓		
	Ensuring calibration of monitoring instruments		✓		
5	Data archiving: ensuring adequate storage of data monitored (integrity and backup): 2 years after the end of the crediting period			✓	
6.	Identification of non-conformance and corrective/preventive actions and monitoring plan improvement		✓		
7	Emergency procedures		✓		
8	External audit				✓
<u>Calculation of GHG emission reductions and reporting</u>					
9	Processing of data and calculation of emission reductions			✓	
10	Monitoring report: management review of monitoring report (internal audit)			✓	

**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):**

Date of completion: 22/07/2010

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**SECTION C. Duration of the project activity / crediting period****C.1. Duration of the project activity:****C.1.1. Starting date of the project activity:**

As per the guidance of EB41 meeting report, the project activity is deemed to have started on April 27th 2008 as this is when the project proponent committed to expenditures related to the implementation of the project activity (the date when the first contract for major construction was signed).

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:**

01/07/2011 or registration date, whichever is later.

C.2.1.2. Length of the first crediting period:

7 years, 01/07/2011 – 30/06/2018

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 impacts 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 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 Psi 3, 4 Hydropower Project, it has undergone an Environmental Impact Assessment. This EIA has been approved by the relevant local authorities, Kon Tum Provincial People's Committee, dated 18th March 2008

The environmental study has been conducted at the feasibility study stage. The EIA study concludes that for the project, it causes given negative environmental impacts but they will be mitigated by the approved solutions and take places mainly in construction. Moreover, it is situated in a remote area. In brief, environmental impacts from the project have been clearly stated and accepted by the local environmental authorities as described below.

Dak Psi 3,4 Hydropower Project is a run- of- river type with small reservoirs and almost of the reservoirs area is river bed, bush and bare hill. Therefore, the negative impacts are fairly limited in scope. However, the impacts are detailed as below:.

A. Assessing the Impacts of the Project on the Environment

1. Impacts on hydrologic regime

The scope of impacts can be divided in to 3 parts:

Part 1 (river bed):

- In the rainy season, there is not any effect on the flow of the river as the power plant use a part of the flooding flow to generate power.
- In the dry season, the flow is not enough for the power to run with full load, therefore, the hydrologic regime of the part from downstream of spillway to the power house will be changed. However, in this part, there are several small streams near the river banks which can supply a significant amount of water to the river. Therefore, the change is not significant.
- As the weir will alter the lay of the river, flow speed will decrease. This may lead to sedimentation upstream of the weir. Besides, the rubbish trapped in the intake gate could cause difficulties for operation.

Part 2 (From the water intake gate to the power house):

- The hydrologic regime in this part may be impacted in the dry season due to the regulation of the power house. However, this part is short and the time bound interruption will not have a significant impact on the local people's activities.

Part 3 (downstream of discharge channel):

As the discharge channel is short with a steep slope, there will be no sedimentation in the discharge channel.



2. Impact on Ecosystem

The intake gate works based on a regulation regime; therefore, there is not much impact on aquatic life. Moreover, the flooding area of the project is small so there is not a significant impact on the flora and fauna near the project site. The project area is also devoid of rare animals and plants.

3. Impact to natural resources

Water resources:

The project uses the natural flow of the Dak Psi river. After running through the plant, water is returned to downstream. Therefore, even during the dry season, the water availability downstream similar to that from before the project was constructed.

Land:

- By surveying the land that comprises of the project area, it was found that most of the land consists of bald hill, some farming land, rubber trees and fields, etc.
- Major construction will be located in the bush, bare hills and thin forest far from residential areas.
- The construction and management road is along the current road to Kon Linh and Dak Po Trang villages, therefore, there will be some impact on farmland due to the road widening.

4. Impact on local people's life quality

The project will not have negative impacts on local people's lives. The operation of the plant will promote the economic development of Dak Ha and Tu Mo Rong districts. The stable source of electricity, especially in the dry season will contribute significantly to the local electric system. It will improve the electric supply as well as help supply the remote areas. By doing so, the project will enhance the local's lives economically.

5. Other impacts

Construction phase:

During this phase, several types of waste such as solid waste (rubble, rock, wood), waste liquids (oil, lubricants, etc), dust (from the construction and transportation of materials and equipment) will pollute surrounding environment.

However, the residential areas are far from project site (40 km), therefore, the impact is not significant.

Operation phase:

In this phase, every year, the plant uses the lubricants for equipment, water for cooling equipment and water for domestic use for the workers. Therefore the project owner needs to prepare the



treatment tanks for waste water from equipment and other sources before discharging to the downstream.

B. Mitigation methods for the negative impacts from the project.

In order to mitigate the negative impacts to hydrologic regime:

- Reduce the soil and mud in Dak Psi river by preventing the discharge of construction waste into the river as well as protecting riverhead forest.
- Reduce the soil and mud in the reservoir by maintenance the discharge gate and dredging the bed to maintain the regulation regime as designed.
- Installing the trash net and trash remover system to remove the rubbish and wood in the water in the flooding season.

In order to mitigate the negative impacts to ecosystem:

- Restrict the waste, oil waste discharge from the plant to Dak Psi river to prevent contaminating the water resource. Minimize the impact to fish and aquatic creatures by shortening dredging time, constructing (if any) in the river bed).
- Protect the nature reserve in the project site and nearby, afforest and reforest the riverhead wood.
- Protect vegetable matter in the slope area near the reservoir and in the project area to minimize the erosion, as well as replant, recover the vegetation cover in the bare area, bush and unused farming land.
- Prevent hunting and selling the rare and specious animals.
- Implement the methods to mitigate people trespassing in the forest such as: control in the entrance gate, or close gate to the forest, etc.

Methods in the construction and operation:

- Organize the management board to check the stability of the foundation pit, the transportation of materials and waste to the discharge area.
- Prepare the discharge area to collect and treat the waste
- Construct the tanks to collect the waste oil, to treat the waste water from equipment and daily activities

C. Environment inspection and monitoring plan

Water quality:



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- Test the water quality during the construction and at least 2 year after the project coming into operation. The test should be done once a month.
- Observe turbidity, DO, BOD, COD, heavy metal, oil in the water during construction.
- Apart from the above observation, in the operation phase, it is necessary to test water temperature, pH, and organic matter.
- Test water quality at 2 points: upstream of the reservoir and downstream of the plant.
- Take the water sample for plankton analysis twice per year.

Noise/Vibration:

- Measure the vibration and noise once per month at the project site and the nearest residential area.
- When the project comes into operation, it is necessary to measure the vibration and noise at the plant twice per year.

Air quality:

- In the construction phase, to test the air quality (CO, NO₂, SO₂, dust) in the project site and the nearest residential area once per month.

In addition, the project owner also commits to an environmental monitoring plan and strictly complies 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 were not considered significant by the Vietnamese authorities and hence the EIA was approved by Kon Tum Provincial People's Committee, dated 18th March 2008

SECTION E. Stakeholders' comments

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

The meeting with stakeholders for Dak Psi and 4 Hydropower projects was held at the project administration house on 09th April, 2010, at 10 am by Dak Psi Hydropower Investment and Development Joint Stock Company in cooperation with the CDM consultant.

Prior to the consultation, an invitation advertisement was placed in the Lao Dong Newspaper and personal invitations made to local community leaders, media, and People's Committee representatives. The participants included representatives of the Department of National Resources and Environment of Tu Mo Rong district, the Chairman of Dak Ha communes and local inhabitants. During the consultation, besides the key points of the project activities, the presentation made by the project owner and consultant also explained, in a non-technical manner, about the environmental and other impacts of the project, climate change, the role of the Clean Development Mechanism as well as annual emission reductions potential of the project. At the end of the presentation, the attendees were encouraged to present their views and questionnaires were provided and opinions elicited from 24 participants.

Fig.E1 – Picture of the local stakeholder consultation meeting on 09 April 2010



E.2. Summary of the comments received:

Stakeholders commented Pros and Cons of executing the mentioned hydropower projects and it was observed that the projects effect positively to environment and locals' lives as well. Opinion varied when mentioning adverse impacts of the projects that are listed below:

- Over 30% comments were about the impacts of construction and operation of hydropower project as it might have an effect on the natural resources or ecosystem as well as human habitat.



- 20% of attendees said the projects would handle or release harmful waste substances (including solid waste) and hazardous materials which were harmful to human health and environment
- Nearly 50% of the attendees worried that the projects could contaminate land or water
- Nearly 40% of attendees thought that the projects would lead to changes in households and jobs. But it was clear that the projects will undoubtedly create jobs for local people both construction and operation phases.
- 20% of the attendees talked about the possibility of earthquakes in the region

A positive aspect about the project improving road and infrastructure was seen by nearly 30% of the respondents.

Concerns about noise and vibration of the projects, the possibility of accidents during construction and operation were raised by 4 people each. Several people (4) stated that areas important for their landscape, historic, cultural or other value may be affected by the project as well as were worried about the flora and fauna in the area. 3 people also commented on the visibility of the project, the presence of areas some are important or sensitive for reasons of their ecology near the project.

In general, the project received positive response from the local community. They foresaw positive impacts from the social, economic and environmental aspects of the project.

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

The project owner thanked everyone for coming to the meeting as well as those who contributed. Following the questions raised by stakeholders, the project owner explained the following:

- The impact on natural resources such as water would be minimal and would be monitored as per Environmental law
- Wastes from the project, especially during construction, would be handled properly as per relevant laws and standards
- Proper measures would be taken to ensure that the project did not pollute the land or water, as per the EIA which had been approved by local authorities
- The project owner assured the people about the creation of jobs by the project

The project owner also explained that impact on local flora and fauna would be limited and monitored as per the EIA provisions. Also explained were strategies for compensating land losses and other assets, restoring income and livelihoods, relocating affected homes and assistance to be given to vulnerable groups in strict compliance with law. The project owner committed to provide adequate and appropriate compensation, commensurate with the needs, aspirations and demands of affected people. Advanced equipments and techniques would be used



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during both construction and maintenance to ensure that the impacts of noise, vibration, and accidents would be reduced.

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

Organization:	Dak Psi Hydropower Investment and Development Joint Stock Company
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City:	Pleiku City
State/Region:	Gia Lai Province
Postcode/ZIP:	
Country:	Viet Nam
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FAX:	
E-Mail:	
URL:	
Represented by:	Ms. Mau Thi Thanh Xuyen
Title:	Director
Salutation:	
Last name:	Mau
Middle name:	Thi Thanh
First name:	Xuyen
Department:	Dak Psi Hydropower Investment and Development Joint Stock Company
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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.



ANNEX 3 - BASELINE INFORMATION

Table AN.1 Amount of consumption, emission and power generation in the most recent 3 years (2006, 2007, 2008)

Power plants	Fuel consumption Coal, oil: kton Gas: mm ³)	Power generating to the grid (MWh)	Emission (t CO ₂)
2006			
Coal thermal power plants	5,645.86	8,989,230	11,823,610
Gas turbines		26,543,978	12,479,578
Gas turbine using gas	5,743,235.28	18,838,764	12,244,651
Gas turbine using oil	70.14	233,582	234,927
Add-on	0	7,470,632	0
Diesel thermal power plant	397.65	1,043,991	1,327,593
Diesel power plant using FO	16.60	80,000	51,642
Diesel power plant using DO	6.39	25,000	20,495
Imported power		937,000	0
Total		37,618,119	25,702,918
2007			
Coal thermal power plants	6,386.09	9,836,548	13,272,897
Gas turbines		29,474,918	13,116,063
Gas turbine using gas	5,910,941.84	20,023,591	12,570,669
Gas turbine using oil	163.27	557,880	545,394
Add-on	0	8,893,447	0
Diesel thermal power plant	614.06	1,834,409	2,046,368
Diesel power plant using FO	25.15	104,626	79,867
Diesel power plant using DO	9.16	42,000	29,088
Imported power		2,629,000	0



Total		43,921,501	28,544,283
2008			
Coal thermal power plants	6,483.99	10,055,394	13,378,811
Gas turbines		33,857,135	14,716,799
Gas turbine using gas	6,839,114.84	22,396,231	14,535,266
Gas turbine using oil	54.35	183,088	181,533
Add-on	0	11,277,816	0
Diesel thermal power plant	534.59	1,481,880	1,784,825
Diesel power plant using FO	22.48	90,465	71,385
Diesel power plant using DO	3.73	15,000.00	11,879
Imported power		3,220,000	0
Total		48,719,874	29,963,699



Table AN.2 Total emission and power generation of the most recent 3 years

	2006	2007	2008	Total
Total power generation (MWh)	37,618,119	43,921,501	48,719,874	130,259,494
Total emission (tCO ₂)	25,702,918	28,544,283	29,963,699	84,210,900

Table AN.3 Result of OM emission factor in 2008

Year	Total power generation (MWh)	Total emission(tCO ₂)	OM ₂₀₀₈ (tCO ₂ /MWh)
	A	B	($\Sigma B / \Sigma A$)
2006	37,618,119	25,702,918	
2007	43,921,501	28,544,283	
2008	48,719,874	29,963,699	
Total	130,259,494	84,210,900	0.6465



Table AN.4 Calculation of BM emission factor in 2008

Power plant	COD year	Fuel consumption (Coal, oil: kton Gas: mm ³)	Power generated to the grid (MWh)	Emission (t CO ₂)
The set of 5 power plants most recently constructed				
A Vuong	2008	Hydropower	168,103.50	
Tuyen Quang	2008	Hydropower	1,136,112.18	
Dai Ninh	2008	Hydropower	1,145,108.50	
Nhon Trach	2008	Gas	166.38	544,808.60
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24
		Add-on		2,728,872.00
Total			7,829,812.02	
The set of power plants most recently constructed contributes 20% of total power generation				
A Vuong	2008	Hydropower	168,103.50	
SROC Phu Mieng IDICO	2006	Hydropower	241,556.00	
Se San 3A	2006	Hydropower	394,895.70	
Tuyen Quang	2008	Hydropower	1,136,112.18	
Dai Ninh	2008	Hydropower	1,145,108.50	
Se San 3	2006	Hydropower	1,131,614.00	
Quang Tri	2007	Hydropower	250,804.40	
Uong Bi 2	2007	Coal	281,759	532,000.00
Na Duong	2005	Coal	532	627,930.00
Cao Ngan	2007	Coal	526	708,693.00
Formosa	2004	Coal	495	560,295.00
Nhon Trach	2008	Gas	166.38	544,808.60
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24



		Add-on		2,728,872.00	
Phu My 2.2	2004	Gas	1,159.75	4,141,980.00	2,510,751
Phu My Nitrogen	2006	Gas	56.15	4,716.00	133,868
CAI LAN - VINASHIN	2007	FO	22.48	90,465.01	71,385
Total				16,514,761.12	8,362,386
Result of BM emission calculation (BM)					
Total emission			8,362,386.08 (tCO ₂)		
Total power generation			16,514,761.12 (MWh)		
BM₂₀₀₈			0.5064 (tCO₂/MWh)		

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Table AN.5 Calculation of Combined Margin

A	Estimated operating margin emission rate	tCO ₂ /MWh	0.6465
B	Estimated build margin emission rate	tCO ₂ /MWh	0.5064
C	Estimated baseline emission rate	tCO ₂ /MWh	0.5764

Annex 4

MONITORING INFORMATION

Monitoring refers to the collection and archiving of all relevant data necessary for determining the baseline, measuring anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary of a CDM project activity and leakage. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on specific energy production parameters.

Data Monitoring

The monitoring methodology involves the monitoring of the kWh by using energy meter(s).

The purpose of the monitoring procedure will be to direct and support monitoring of project performance project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions. The project employs latest state of art monitoring and control equipment that measure, control and record key parameters continuously.

Ensuring adequate maintenance and calibration of monitoring instruments

- Specific maintenance, repair or replacement of monitoring equipment will be recorded and will describe the time and action undertaken.
- The calibration will occur at intervals determined on the basis of instrument manufacturers' recommendations, stability, purpose, usage and history of repeatability. Recalibration should be performed whenever an event occurs that places the accuracy of the instrument in doubt.
- Energy meters are delivered with a certificate of conformity and are not calibrated after installation. They will be calibrated at least every three years after the first year of service.
- Last calibration certificates and next calibration date will be provided during periodic verification
- Defect, repair or change of monitoring equipment will be recorded.

Data Archiving

The monitored data will be kept for a minimum of 2 years after the end of the crediting years by using paper documents and electronic files.

Identification of Non-Conformities

A verification of inconsistencies of the data recorded will be performed periodically. Any discrepancies (completeness, calculation errors, transcription errors, instrument calibration issues) will be analyzed and actions taken to correct the problem.

CDM – Executive Board**Emergency Procedures (Monitoring)**

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).

Ensuring Adequate Training of Staff

- All new staff will undergo ‘on job training’ covering the monitoring requirements
- The monitoring plan will be made available to each staff involved in the monitoring in the local language. A copy is located in the control room at the site.
- During the training, staff is required to sign training attendance list.
- All training record shall be documented inclusive of training attendance, training memo and training material if any.
- Type of training required will be indicated from Training Need Analysis conducted yearly. The record of training and awareness should be kept for at least 2 years after the crediting period.

Power purchasing company name: Electricity of Viet Nam (EVN)

Connection point details: The electricity generated from Dak Psi 3,4 Hydropower Project will be connected to the National Grid through 110 kV transmission line

Project Manager Name: Ms. Mau Thi Thanh Xuyen, Director of the company

Site Manager Name: TBC