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

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

Name of the project: Nuoc Trong Hydropower project.

Version of document: 01

Date of Completion: 01/09/2010

A.2. Description of the project activity:

The Nuoc Trong Hydropower project (hereafter refers to "the proposed project") is located in Son Bao commune, Son Ha district, Quang Ngai province, Social Republic of Vietnam. The project involves construction of a new hydropower plant on the existing Nuoc Trong resevoir.

The proposed project will install 3 sets of generators and turbines to generate electricity, with the gross installation capacity of 16.5MW. The annual net power supply is estimated to be 67,817MW with the operation hours of 4194h/y[1]. Same amount of power was supplied by Viet Nam National Grid before implementation of the project. The baseline scenario of the proposed project is the same with the scenario existing prior to the proposed project.

The proposed project will reduce GHG emission by using hydropower to generate electricity. It could substitute a part of power from Viet Nam National Grid, which is dominated by power from thermal power plants. It is estimated that the proposed project will generate 39,090 tCO_2e emission reductions comparing to the baseline scenario.

The proposed project will also contribute to the sustainable development for the host party country by means of:

- Supplying clean renewable energy to the Viet Nam National Grid and improving the local energy structure;
- Creating job opportunities during the projects' construction phase and operation phase;
- Promoting local areas' economic development;
- Mitigating GHG emissions and emissions of other pollutants comparing to thermal power generation.

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)

[1] According to 20 years historical hydrological data, the annual operation hours are estimated to be 4194h; auxiliary power consumption is estimated to be 2% of the power generation according to the project FSR.

Socialist Republic of Viet Nam (Host)	Nuoc Trong Hydropower Joint Stock Company	No
United Kingdom of Great Britain and Northern Ireland	Camco Carbon Southeast Asia Ltd	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Vietnam

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

Quang Ngai province.

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

Son Bao commune, Son Ha 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 activity involves the construction of Nuoc Trong powerhouse which is located on the Nuoc Trong River in Son Bao commune, Son Ha district, Quang Ngai province of Vietnam. The project has co-ordinates as follows:

- Northern Latitude: $15^{0}03^{'}00^{''}$
- Eastern Longitute: $108^{0}25^{'}00^{''}$.

The site of the project is shown in the Figure below:

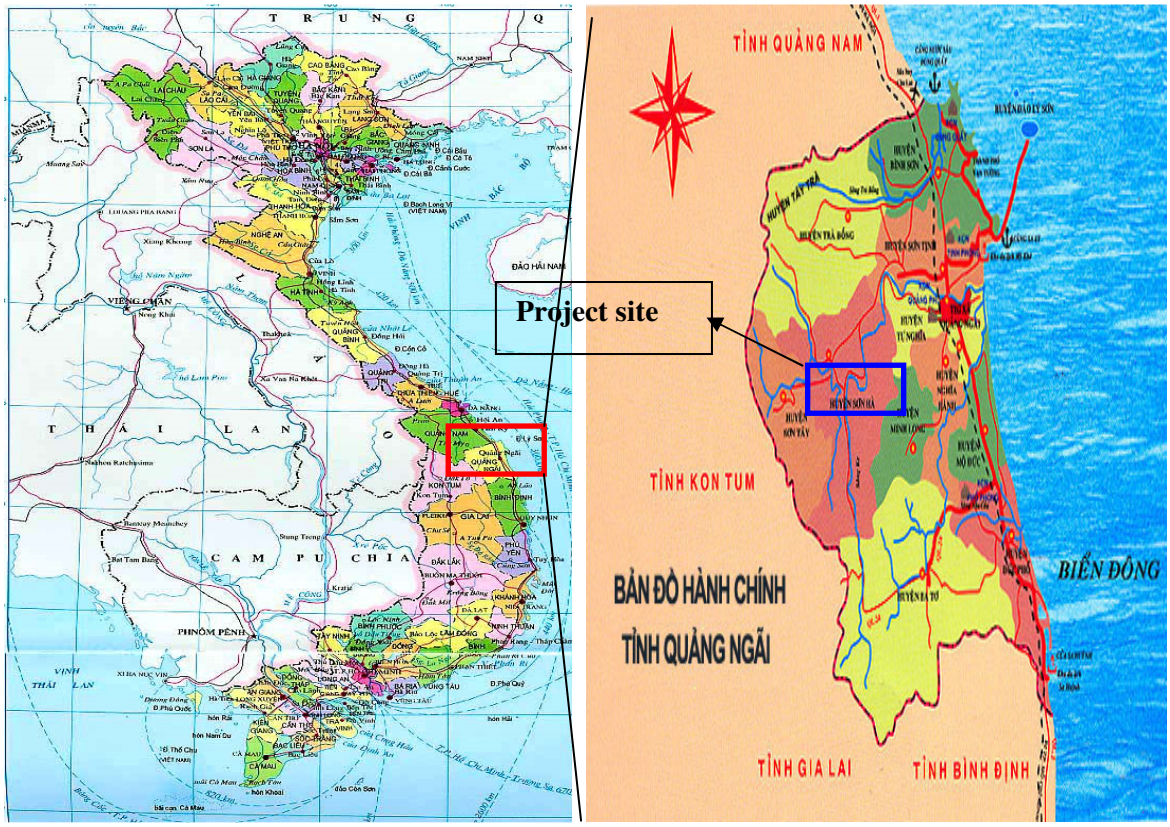

Figure 1: Map of the location of the project activity

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

Sectoral scope 1: Energies Industry (renewable-/non-renewable sources)

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

Prior to the implementation of the proposed project, electricity supplied to the national grid is generated by the operation of grid-connected power plants. Electricity in Vietnam is generated mainly by firing coal, oil or gas and is solely distributed via the unique national electricity grid. All fuel fired power plants connected to the national grid use boiler rooms, steam heating boilers and steam turbines to generate electricity. In that technology cycle, GHGs are generated.

The project involves the construction of a new grid-connected hydropower plant and the installation of new hydro turbines and generators in order to convert potential flowing energy of water from the Nuoc Trong reservoir. Since hydro power generation technology is a renewable electricity generation technology which displaces fossil fuel fired power generation technology to supply electricity to the grid, the implementation of this project activity will generate emission reductions.

Figure below shows the layout of the project.

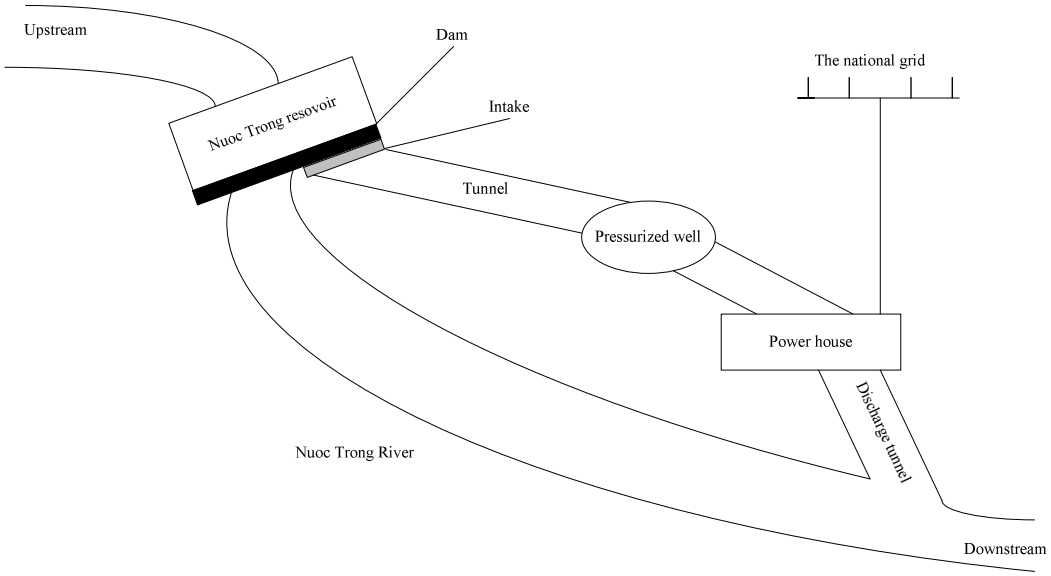

Figure 2: Project lay-out

The main equipments are imported from China. Main technical parameters of the the proposed project are shown in Table 1.

Table 1: Main technical parameters of the proposed project activity[2]

Main parameters	Units	Values
1. Turbine		
• Type		Vertical shaft Francis (HLA616-LJ-133 quoted from technical specification of supplier)
• Rated net head	m	45.5
• Number of Turbine	set	3
• Efficiency	%	91.54
• Capacity	kW	5792
• Speed	rpm	375
• Annual utilisation hours	hour	4194
2. Generator		
• Number	set	03
• Type		Synchronous, 3 phases, horizon axis
• Rated voltage	kV	6.3
• Rated capacity	MW	5.5
• Efficiency at 100% load,Cosφ=0.8	%	96.9
3. Transformer		

[2] The contract on supplying equipment and technical document

• Number	set	3
• Primary voltage	kV	6.3
• Secondary voltage	kV	38.5

The project activity does not involve any greenhouse gas emissions or burning of any fossil fuels during the process of power generation, and the technology applied for the project activity is environmentally safe and sound.

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

Fixed crediting period is selected for the proposed project. The estimated emission reductions over the crediting period (Jul.1st, 2011-Jun.30th, 2021) are 390,900 tCO_2e.

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2011 (Jul.1st –Dec.31st)	19,545
2012	39,090
2013	39,090
2014	39,090
2015	39,090
2016	39,090
2017	39,090
2018	39,090
2019	39,090
2020	39,090
2021 (Jan.1st – Jun.30th)	19,545
Total estimated emission reductions (tCO_2e)	**390,900**
Number of the fixed crediting years	**10**
Annual average over the crediting period of estimated reductions (tCO_2e)	**39,090**

A.4.5. Public funding of the project activity:

There are no public funds involved in 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:

Applied methodology:

- Version 12 of ACM0002: "Consolidated baseline methodology for grid-connected electricty generation from renewable sources"

Related tools:

- Version 02 of the "Tool to calculate the emission factor for an electricity system"
- Version 05.2 of the "Tool for demonstration and assessment of additionality"

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

The proposed project meets all the applicability conditions of ACM0002 (Ver.12) which are justified as follows:

	Applicability Criteria	Applicability	Project Activity
1	The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	Applicable	The proposed project is the construction of a new hydro power plant on the existing reservoir
2	In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on methodology ACM0002 page 10 to calculate the parameter $EG_{PJ,y}$: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the	N/A	The proposed project is the construction of a new hydro power plant on the existing reservoir

	plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.		
3	In case of hydro power plants: • The project activity is implemented in an existing reservoir, with no change in the volume of reservoir • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density (installed power generation capacity divided by the surface area at full reservoir level) of the project activity, is greater than 4 W/m^2; or • The project activity results in new reservoirs and the power density of the power plant is greater than 4 W/m^2.	Applicable	The project activity is implemented in an existing reservoir[3] with no change in the volume of reservoir.

Therefore, ACM0002 is applicable to the proposed project activity.

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

According to ACM0002 (Ver.12), the physical, geographical site of the renewable generation source delineates the project boundary. For the proposed project, the project boundary includes the Nuoc Trong Hydropower plant's power generation equipment and the power plants involved in Viet Nam National Grid, to which the proposed project will be connected.

The flow diagram of the project boundary is shown in Figure 3 below:

[3] The reservoir will be operated almost the same time with the power plant, but the reservoir is constructed not for the power generation. The main purpose of the reservoir is for irrigation, avoiding floods in the low section river. The reservoir belongs to a different entity and is approved by government before the power plant owner initiated the project. Therefore, the reservoir is considered as an existing reservoir.

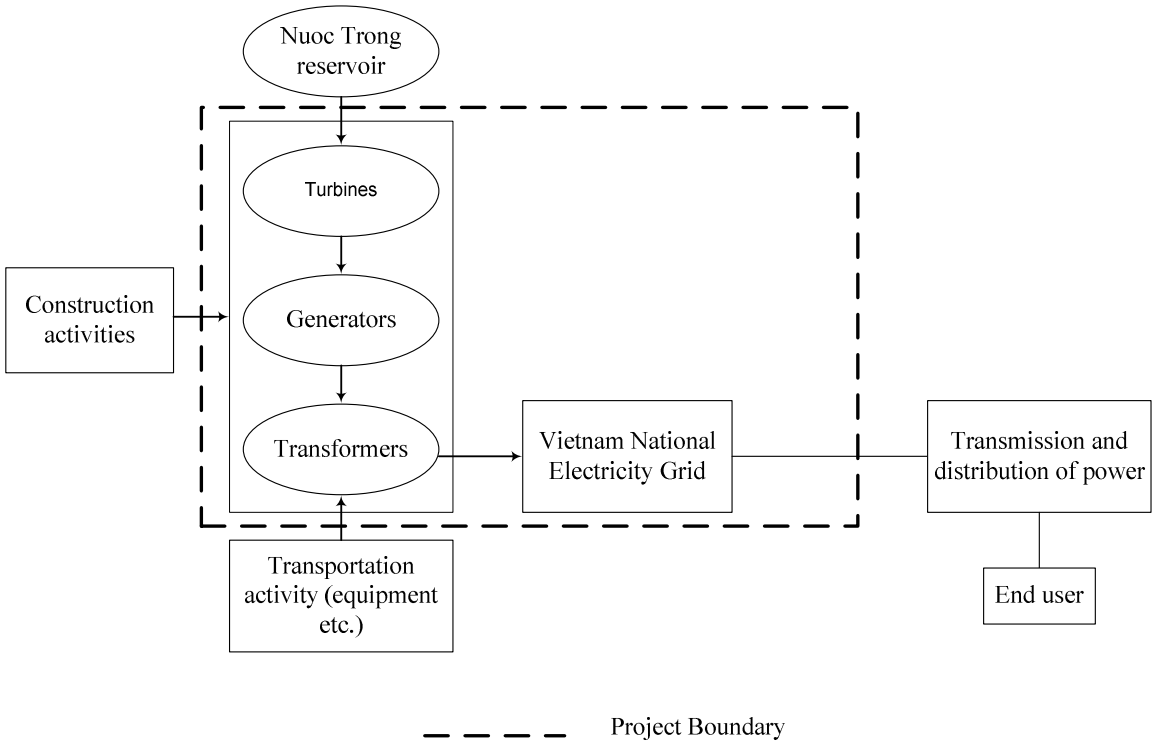

Figure 3: Project Boundary

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

Table 4: Sources and gases included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO2 emission from electricity generation in fossil fuel fired power plants that is displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activities	For hydro power plants, emissions of CH4 from the Reservoir	CO_2	No	Excluded for simplification.
		CH_4	No	The proposed project is the construction on an existing reservoir, and project emission from reservoir does not need to be considered.
		N_2O	No	Excluded for simplification.

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

As per ACM0002 (Ver.12), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario should be as follow:

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 proposed project is the constructrion of a new hydropower plant on an existing reservoir, and the proposed project will be connected to Viet Nam National Power Grid, which is dominated by power from thermal power plants. Therefore, the baseline emission for the project should be calculated as the grid emission factor multiplying the net power supply. Detailed information sees also in part B.6.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

Prior consideration of CDM

CDM has been seriously considered by the project owners prior to the commencement of the construction, and a series of continuing actions have been taken by the project participants to secure CDM support throughout the planning and construction phases. The chronology for the proposed project is as follows:

Table 2: Timeline for the proposed project

Date	Work
02/2008	MOU with Camco
24/02/2008	Completion of FSR showing that Project IRR is lower than benchmark
03/03/2008	Board decision making to invest on the project and develop it as a CDM project
05/2008	CADPA with Camco
05/05/2008	Construction contract
09/02/2009	Bank Loan commitment
18/03/2009	Bank Loan Contract
01/06/2009	CDM stakeholder meeting

27/08/2009	Equipment contract signing

Additionality

According to ACM0002 (Ver.12), the additionality of the project should be assessed using the latest version of the "Tool for the Demonstration and Assessment of Additionality" (in this case version 05.2, EB39)

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 as alternatives for the project activity with respect to credibility:

a) The proposed project activity undertaken not as a CDM project activity;
b) Construction of a fossil fuel power plant with equivalent amount of annual electricity generation;
c) Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation;
d) Continuation of the current situation: provision of equivalent electric power by Viet Nam National Grid.

Alternative c) is not realistic because local area (Quang Ngai Province) has no other renewable resource for power generation and only does project owner have perception in hydropower among renewable energies.

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

Alternative b) is not realistic. According to the Master Plan of Electricity Expansion for period of 2006-2015 with perspective to 2025 - EVN (Master Plan VI) approved by the Prime Minister in July 2007 which is the latest publicly information source listed all operated and planned power plants in Vietnam, there is not any fossil fired power plant with the equivalent and lower power output is constructed/under construction and/or planned in Vietnam or Quang Ngai province. According to the Electricity Law, the investment in electricity generation must be complied with the Master plan. However, in the point of view for electricity development by Ministry of Industry and Trade, the common capacity of thermal power unit within next 10 years is 300 MW and in the future the higher capacity (600 MW and higher) will be chosen for reducing the investment cost. It shows that the investment and operation of such thermal power plants with the capacity equal and below 16.5 MW is not realistic in Vietnam.

Outcome of Step 1: Option a) and Option d) are realistic and consistent with Mandatory Laws and Regulations.

Step 2: Investment Analysis

Sub-step 2a: Determine Appropriate Analysis Method

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). The investment comparison analysis method (Option II) is applicable to projects whose alternatives are similar investment projects. The alternative baseline scenario of the project is Viet Nam National Grid providing equal amount of electricity rather than new investment projects. Therefore Option II is not an appropriate method. The project will use the benchmark analysis method (Option III) assuming that the benchmark IRR of the project is available.

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

Additionality Tool Ver. 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 benchmarks shall be derived from:

(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;
(b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;
(c) A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by the same company used the same benchmark;
(d) Government/official approved benchmark where such benchmarks are used for investment decisions;
(e) Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified.

Besides, the "Guidelines on the Assessment of Investment Analysis" issued by EB in its 51st meeting requires 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. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented".*

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 (March

2008), the State Bank of Vietnam formulated base interest rate rate was 8.75%[4]. 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 rate[5], meaning that the ceiling for interest rate of commercial banks at the time of decision making was 13.125%.

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% (the actual rate paid when interest is compounded over the year)[6].

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%.[7]

The benchmark of 12% chosen, therefore, fulfils all the criteria laid down by the Additionality Tool5 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 were considered in making the projected income statement and IRR computation:

Table 5: Key Input Parameters

Parameters	Value	Basis
Installed capacity (MW)	16.5	FSR certificate
Annual power supplied to the grid (MWh)	69,201	Computed
Auxiliary consumption (as percent of generation)	2.0%	General norm, transmission and distribution losses
Total Investment (billion VND)	303,084	FSR certificate
Loan: equity ratio	24:76	FSR certificate
Lending during construction phase	38,514	FSR

[4] http://www.sbv.gov.vn/

[5] Civil law no. 33/2005/QH11, dated 25/12/2001

[6] IMF Country Report No.07/386

[7] Electricity of Vietnam Master 6

Total investment without lending	264,570	FSR
Power tariff (VND/kWh)	640	Decision 2014 and common practice
O&M cost (as percent of project cost)	2.0%	FSR and decision 2014
Insurance (as percent of project cost)	1%	Decision 2014
Interest rate on term loan – in VND	12%	Feasibility Report
Natural Resource Tax (as percent of revenue)	2.0	Circular No 05/2006/TT-BTC
Tax rate for using water from irrigation reservoir (as percent of revenue)	12%	Government decision
Lifetime of the project without any major refurbishment for main equipment	20 years- inlined with decision 2014/QD-BCN[8] and QD206-2003-BTC[9]	

[8] Decision 2014/QD-BCN dated 13/6/2007 for financial analysis of electricity projects

[9] Decision 206/2003/QD-BTC dated 12/12/2003

The IRR calculations were based on the following conservative assumptions:

- Total operating costs do not include escalation of O&M cost.
- Corporate tax is excluded from the calculation.
- Proposed project has not signed the Power Purchase Agreement (PPA) by the time of writing the PDD. According to Decisison 2014, the tariff for hydropower projects with installed capacity lower than 30MW ranges from 2.70 (abundant water period) -5.20 (withered water period) US$cent/kWh, whereas the historical average tariff in Viet Nam for hydropower plants is 3.77 US$cent/kWh. Based on the above assumptions, in the IRR calculation the applied tariff for the project was of 4.0 US$cent/kWh and it is considered to be conservative.

The results of the IRR calculations are shown in table 6 below:

Table 6: IRR of Nuoc Trong Hydropower Project

Nuoc Trong		
Project IRR	Without CDM	**10.06%**
	With CDM	**14.94%**
Benchmark	**12%**	

In accordance with the benchmark analysis if the financial indicators (such as the IRR) of a project are lower than the benchmark, the project is not considered to be financially attractive. From the table above, we find that the IRR for the proposed project (without CDM benefit) is 10.08%, which is lower than the selected benchmark (12%) and therefore the project is not financially attractive.

With the CDM revenue, the project IRR will be significantly improved and will exceed the benchmark. Therefore, the project with CDM revenue can be considered as financially attractive to investors.

Sensitivity analysis

The robustness of the conclusion drawn above has been tested by subjecting critical assumptions to reasonable variations. Guidelines on the Assessment of Investment Analysis define 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 17 and 18 of the Guidelines). Four factors have thus been identified as sensitive, viz., project cost, O&M cost, plant load factor (number of annual operating hours) and tariff. The impact of a "reasonable variation" in these four parameters on the project IRR have been worked out and the results are as follows:

Table 7: Sensitivity analysis of Nuoc Trong Project

Variation / Parameter	**-10%**	**-5%**	**0%**	**5%**	**10%**
Total Investment	11.66%	10.82%	10.06%	9.35%	8.70%
OM Cost	10.25%	10.15%	10.06%	9.96%	9.86%
Power Tariff	8.26%	9.17%	10.06%	10.93%	11.78%
Plan Load Factor	8.26%	9.17%	10.06%	10.93%	11.78%
Benchmark	**12%**				

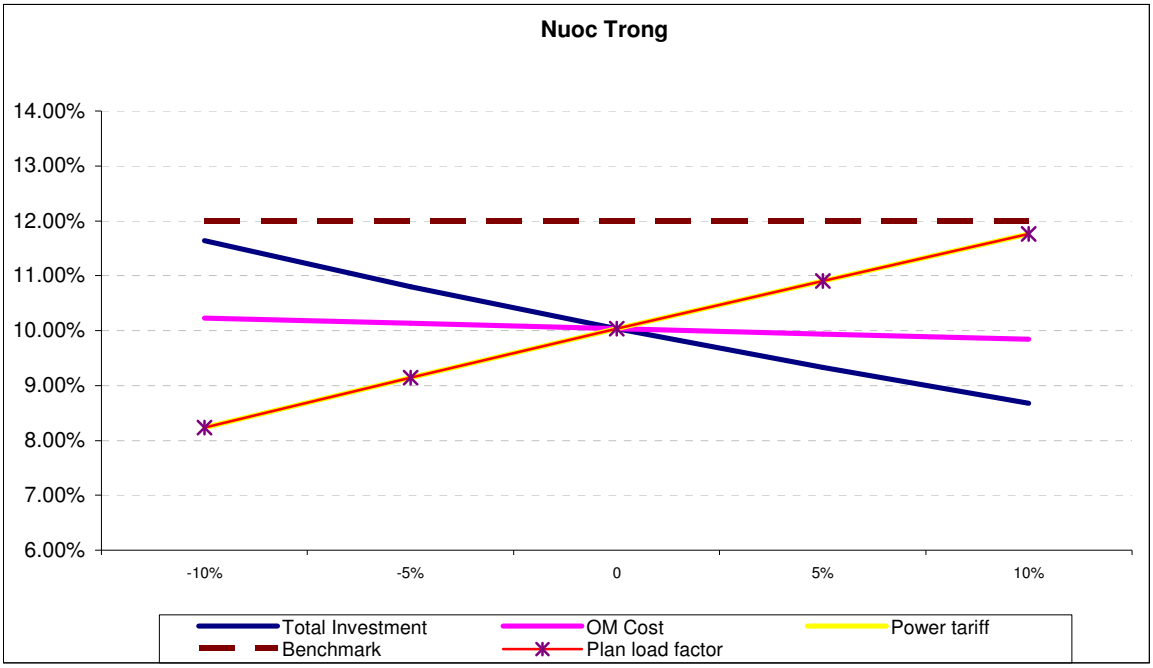

Figure 4: Sensitivity analysis of Nuoc Trong Project

The sensitivity analysis shows that even when the parameters vary by ±10%, IRR of Nuoc Trong project could not reach the benchmark and the conclusion that the Proposed Project is financially unattractive still holds.

Table 8 shows changes needed to reach benchmark 12%.

Table 8: Sensitivity analysis of change needed to reach benchmark of 12%

Parameters	Nuoc Trong Hydropower project
Power tariff	11.3%
Operational hours	11.3%
Construction investment	-11.8%
O&M cost	-103%

In reality, these scenarios are highly unrealistic for the following reasons.

Operational hours

The project IRR will reach 12% when the operation hours increase 11.3%. However, the annual operation hours is calculated according to historical hydrological data. With the proposed project activity, the annual operation hours were estimated based on 20 years of historic hydrological data as presented in the FSRs. Therefore it is highly unlikely that the annual net electricity supply would increase by so much to meet the benchmark.

Electricity tariff

The project IRR will reach 12% when the electricity tariff increases 11.3%. In Viet Nam, power tariff is strictly controlled by the government, and net increase of more than 10% for electricity price is impossible. The government only increases tariff rate due to the rise of PI of operation cost of power generation such as materials, labour costs and interest rate of the loan etc. In that case, the annual operation cost will also go higher, and there is no actual increase on power tariff. Continuous endeavors from project developer have been carried out to officially know about the Power tariff in Vietnam for independent proponent projects and the learnt price until now is 602 VND/Kwh and it has been being kept for 10 years. This tariff is even lower than the number being utilized in calculating the finance of the project.

Construction investment

The project IRR will reach 12% when the construction decreases by 11.3%. It is not likely for the investment costs to decrease to the level required to meet the benchmark. Viet Nam has been experiencing a period of inflation since 2007, consequently, the price of materials, construction costs and relevant other costs are increasing. Thus decrease of construction investments is not realistic.

O&M cost

When the O&M cost of Nuoc Trong reduces 103%, the project IRR could touch benchmark, but it is impossible to decrease more than 100% (O&M cost could never be minus).

Outcome of Step2: It is concluded that the proposed project is not financially attractive without the additional revenue from CERs.

Step 4: Common practice

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

Government Decree No 45/2001/ND-CP created a legal basis to allow other entites to invest in and generate electricity rather than only state-owned entites as previously regulated. Before that time, all power plants have been invested from the state budget sources and operated by state owned companies. Hence, any hydropower projects that have been started the construction activities before August 2001 are not subject to this analysis.

In the light of "*Tool for the demonstration and analysis of additionality*", the similarity of compared projects are defined: "*Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc*"

According to Vietnam Construction Code -TCXDVN 285:2002 "Irrigation projects - Major standards on designing"[10], hydropower projects are categorized as follows:

Table 9: Groups of hydropower projects according to Vietnam Construction Code-TCXDVN 285:2002

Group	Capacity
I	Equal and larger 300MW
II	Equal and Larger 50MW but smaller 300MW
III	Smaller 50MW but equal and larger 5MW
IV	Smaller 5MW but equal and larger 0.2MW
V	Up to 0.2MW

According to Prime's Minister Decision No 176/2004/QD-TTg[11], private entities are encouraged to invest in such small scale projects. Also referring to Prime's Minister Decision No 176/2004/QD-TTg, private entities are not encouraged to invest in hydropower projects with capacity above 100 MW. Furthermore, according to Decision of Ministry of Industry No 3454/Qd-BCN [12] dated 18 October 2005 on development plan of small-scale hydropower projects, hydropower projects having installed capacity within the range 1 ÷ 30 MW are categorised as small scale projects.

In combination of above mentioned regulations, the hydropower projects are classified into group as follows for serving common practice analysis:

Table 10: Groups of hydropower projects serving for common practice analysis

Group	Installed capacity	Referred regulations
A	Equal and larger 300 MW	Vietnam Construction Code- TCXDVN 285:2002

[10] Vietnam Construction Code-TCXDVN 285:2002 "Irrigation projects- Major standards on designing"

[11] Prime Minister Decision No 176/2004/QD-TTg

[12] Decision of Ministry of Industry- No 3454/QD-BCN

B	Larger 100 MW and smaller 300 MW	Vietnam Construction Code- TCXDVN 285:2002 and Prime's Minister Decision No 176/2004/QD-TTg
C	Equal and larger 50 MW and equal and smaller 100 MW	Vietnam Construction Code- TCXDVN 285:2002
D	Smaller 50 MW and larger 30 MW	Vietnam Construction Code- TCXDVN 285:2002, Prime's Minister Decision No 176/2004/QD-TTg, and Decision of Ministry of Industry – No: 3454/QD-BCN
E	Equal and smaller 30 MW and larger 5MW	Vietnam Construction Code- TCXDVN 285:2002, Prime's Minister Decision No 176/2004/QD-TTg, and Decision of Ministry of Industry – No: 3454/QD-BCN
F	Up to 5 MW	Vietnam Construction Code- TCXDVN 285:2002, Prime's Minister Decision No 176/2004/QD-TTg, and Decision of Ministry of Industry – No: 3454/QD-BCN

From the defined table, this proposed project activity falls into Group E. Filtering from Master Plan IV[13], projects with *similar scale and take place in a comparable environment* to the proposed project activity are introduced in the following table:

Table 11: Hydropower plants in group E

No	Name	Capacity (MW)	Comissioning year	Developed as CDM project
1	Nam Mu	12.0	2004	No
2	Ea Krong Rou	28.0	2007	No
3	Suoi Sap	14.4	2007	No
4	Na Loi	9.3	2003	No
5	Ngoi Xan 1	8.1	2007	Yes
6	Nam Tha 6	6.0	2007	Yes
7	Coc Dam	7.2	2008	Yes
8	Nam Ngan	13.6	06/2009	Yes
9	An Diem II	15.6	12/2009	Yes
10	Tra Linh 3	7.5	12/2009	Yes
11	Nam Pia	15.0	09/2009	Yes

The exclusion of projects which are developed under CDM remains with 4 projects and is illustrated in the following table:

Table 12: Hydropower plants belong to group E were developed in Vietnam

Order	Plant	Capacity (MW)	Investor
1	Nam Mu Hydropower Project	12.0	Song Da Holdings
2	Na Loi	9.3	Song Da Holdings

[13] Master Plan of Electricity Expansion for period of 2006-2015 with perspective to 2025- EVN

3	Ea Krong Rou Hydropower Project	28.0	Central Hydropower Joint Stock Company
4	Suoi Sap Hydropower Project	14.4	Truong Thanh Limited Company

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

1. Nam Mu Hydropower project was invested and built by Song Da Holdings. This project started commercial production March 24, 2004 after 18 months construction shorter than original schedule (30 months)[14]. Song Da Holdings is a stated-own corporation, formed in 1961 and belongs to Ministry of Construction. This corporation has been having experience in hydropower sector through constructing many hydropower plants such as Thac Ba (110 MW), Hoa Binh (1,920MW), Tri An (400 MW), Vinh Son (66MW), Yaly (720MW), Tuyen Quang (342MW), Son La (2,400MW)[15]. Therefore, Song Da Holdings does not face technological barrier and also financial issues since it receives financial assistance from government to implement the power strategy in Viet Nam. The Nam Mu Joint Stock Company is run by Song Da No. 9 Company, a subsidiary of Song Da Corp. and it was formed to operate Nam Mu Hydropower Plant since May 29, 2003. In conclusion, this plant can not be considered similar to proposed project activity.

2. Na Loi Hydropower project was invested and built by Song Da Corp[16] by BOO method "Build – Operate – Own". This project was commissioned in 07 May 2003 and like Nam Mu Hydropower Plant, Na Loi Joint Stock Company was formed August 01, 2003 to operate in Na Loi Hydropower Plant and Song Da Holdings holds 51% of its share. Clearly, this project does not face financial barrier since it is invested by state-owned company. In conclusion, this plant can not be considered similar to proposed project activity.

3. Ea Krong Rou Hydropower project was invested and operated by MienTrung Power Investment and Development JSC, a subsidiary of Song Da Holdings. As discussed above, this project does not face financial barrier like Nam Mu and Na Loi hydropower projects. Hence, this can not be considered similar to proposed activity

4. For Suoi Sap project, initially the purpose of this project was to supply water for 700 ha planting commercial and rice fields in Phu Yen District Son La province. Then, the company decided to synergise with the construction of a hydropower plant after recognizing the additional benefit from this project. Also, according to the Government Decree No. 17/2001/ND-CP, this project will be given priorities to access ODA. Then, this project has borrowed ODA soft-loan from India at a very favourable interest rate while the proposed project has to take loans from domestic banks without such a favourable condition. In addition, the project was one part of 661program –

[14] http://thuydiennammu.com.vn/index.php?option=com_content&view=article&id=1:gii-thiu-cong-ty&catid=2:gii-thiu-cong-ty&Itemid=2

[15] http://www.songda.vn/info/info.do?info=intro

a Government program to increase forestry cover in Son La province[17]. Therefore, this project also received special financial assistance through Government program. The circumstances of this project thus clearly show that this project has not been facing a similar barrier as the proposed project.

In addition, the proposed project uses water from irrigation reservoir managed by the other organization. The operational hours is strictly depended on the time schedule of water supply because the reservoir is built mainly for irrigation. The substantial amount of electricity of the proposed project is generated in the dry season whilst it is very little in the flood season; this fact is totally different from most of hydropower plants. The proposed project is invested when the project owner wants to exploit hydro potential to generate electricity. When compared the number of operational hours of the proposed project with above mentioned hydropower plants in following table, the operational hours of the proposed project is lowest. Since the number of operational hours affects directly on electricity output and the revenue of the proposed project activity, its difference will lead to the difference of financial benefit.

Table 13: The number of operating hours of proposed project activity and compared projects in the common practice analysis

Project Name	Installed capacity (MW)	Location	Region	Annual operation time (hour/year)
Nam Mu Hydropower	12	Bac Giang district, Ha Giang province	Northeastern	4833
Na Loi Hydropower	9.3	Dien Bien district, Lai Chau province	Northwestern	4978
Ea Krong Rou Hydropower	28	Dinh Tay district, Khanh Hoa province	Central	4286
Suoi Sap Hydropower	14.4	Phu Yen district, Son La province	Northwestern	4563
Nuoc Trong Hydropower	16.5	Son Ha district, Quang Ngai province	Central	4194

In conclusion, the proposed project is **not a common practice** since it is invested by a private entity and it does not receive any financial assistance from Viet Nam Government. In addition, the number of operational hours of the proposed project activity is lowest and this will make it less beneficial when compared with the mentioned projects.

In summary, it is only through the inclusion of CDM revenues that the project becomes financially attractive and the intention to register the project under the CDM was a determining factor in the decision to proceed with the project. It is therefore concluded that the project is not the baseline scenario and is additional

[16] http://www.naloi.com.vn/?page=introduce&et=news&category_id=5

[17] http://www.baodientusonla.com.vn/NewsDetail.Asp?ID=7973

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The reduced emission is calculated in accordance with the approved consolidated baseline methodology Version 12 of ACM0002.

1.Project activity emissions (PE_y)

According to the methodology, for hydro project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, PE_y is equal to $PE_{HP,y}$:

a) If the power density of the proposed project (PD) is greater than 4W/m^2 and less than or equal to 10W/m^2

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000}$$ **Equation 1**

Where:

$PE_{HP,y}$	= Project emission from water reservoirs (tCO_2e/yr)
EF_{Res}	= Default emission factor for emissions from reservoirs of hydro power plants in year y ($kg\ CO_2e/MWh$)
TEG_y	= Total electricity produced by the proposed project, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh)

b) If the power density of the proposed project (PD) is greater than 10W/m^2 :

$$PE_{HP,y} = 0$$ **Equation 2**

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

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ **Equation 3**

Where:

PD	= Power density of the proposed project (W/m^2)
Cap_{PJ}	= Installed capacity of the hydro power plant after the implementation of the proposed project (W)
Cap_{BL}	= Installed capacity of the hydro power plant before the implementation of the proposed project (W). For new hydro power plants, this value is zero
A_{PJ}	= Area of the reservoir measured in the surface of the water, after the implementation of the proposed project, when the reservoir is full (m^2)
A_{BL}	= Area of the reservoir measured in the surface of the water, before the implementation of the proposed project, when the reservoir is full (m^2). For new reservoirs, this value is zero

2.Baseline Emission (BE_y)

Baseline emissions include only CO_2 emissions from electricity generation from fossil fuel fired power plants that are displayed due to the project activity, calculated as follows:

$$BE_y = EG_{PJ,y}.EF_{grid,CM,y} \quad \textbf{Equation 4}$$

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 CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

If the project activity is the installation of a new grid-connnected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$EG_{PJ,y} = EG_{facility,y}$

Where:

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

Calculation of the emission factor (EF) of the national electricity grid

On 26th of March, 2010 Vietnam DNA has released the value as well the calculation way of Emission factor of Vietnam National Grid. This report was strictly based on *"Tool to calculate the emission factor for an electricity system"* version 1.1 issued in EB 35. In comparision with the newest version of this tool, version 2, the steps for calculation as well the justification of data are almost unchanged; hence the utilization of this report is reliable. Details specifications are described below:

Step 1: Identify the relevant electricity systems

The electricity generated by the proposed project will be delivered to the Viet Nam National Grid. Nuoc Trong power plant is physically connected to the national grid; hence this is the relative electricity system for the proposed project.

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

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

In Vietnam, the National grid is reliable and stable. Also, off-grid power plants just fulfill the minor own request of producer; hence they are not significant. In summary, Option I is chosen to calculate the proposed project's operating margin and build margin emission factor.

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

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

(a) Simple OM
(b) Simple adjusted OM
(c) Dispatch data analysis OM
(d) Average OM

Option (a) - Simple Operation Margin can only be used if low-cost/ must- run resources is appropriate option to calculate the OM when low cost/must run resources constitute less 50% of the total power generation of the grid. Within the most recent 5 years for which data is available for power generation of Viet Nam Power (2004-2008), the proportion of power generated by low cost and must run resources was below 50% being 39.71%, 32.52%, 34.13%, 33.74%, and 34.72% in 2004, 2005, 2006, 2007 and 2008 respectively.

Table 15: Low cost/ must run resources

	2004	2005	2006	2007	2008
Low-cost/must-run	39.71%%	32.52%	34.13%,	33.74%	34.72%

Option (b) - the option of Simple Adjusted Operation Margin Emission Factor will require the power grid to provide annual Load Duration Curve. However, this option requires detailed running dispatch data of the connected-grid power plants. However, this data is not publicly available in Viet Nam so option (b) is not feasible.

Option (c) - Calculation of OM from grid dispatch data analysis can give the most reliable estimation of emission reduction since this method counts the actual portion of the baseline power which will be substituted by the output of the CDM project. For the same reason as Option (b), the project also could not gain the detailed dispatching data from EVN. Therefore, option (c) is also not feasible.

Option (d) - the average OM is suitable for power grids where low cost and must run[18]power plants constitute more than 50% of the total grid power generation. Since the proportion of power generated by low cost and must run resources was below 50% within recent 5 years, option (d) cannot be applied.

[18] Low-cost/must run resources based on electricity generation is typically hydropower generation in Viet Nam where the state owned EVN defines only hydropower as "low cost". Though in some situations coal can be considered as low-cost/must-run, in Viet Nam coal power constitutes less than a third of thermal generation and less than a fifth of total generation. Furthermore, none of the coal-fired power stations in Vietnam run at full capacity – there is a typical load factor of under 50%. Coal power stations function in response to variations in the seasonal load – in particular making up the shortfall in hydropower generation during the dry season – and therefore should not be considered as must-run.

As shown above, low cost/ must run power generation in Viet Nam constituted less than 50% of the total in the recent past, therefore, the project will use option (a) to calculate the Operation Margin.

The simple OM is calculated ex-ante using a 3-year's generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

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

The simple OM emission factor ($EF_{OM,Simple,y}$) is the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. It may be calculated:

- Option A: Based on net electricity generation and a CO_2 emission factor of each power unit; or
- Option B: Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system

Option A is selected to calculate the OM emission factor. Under this option 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:

Equation 5: $$\mathbf{EF_{grid,OMsimple,y}} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{\mathbf{m}} \mathbf{EG_{m,y}}}$$

Where:

$EF_{grid,OMsimple,y}$	= Simple operating margin CO2 emission factor in year *y* (tCO_2/MWh)
$EG_{im,y}$	= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	= All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
y	= The relevant year as per the data vintage chosen in step3

In the DNA report, data related to fuel consumption and electricity generation is available, the emission factor ($FEEL_{,m,y}$) is determined as follows:

Equation 6: $$EF_{EL,m,y} = \frac{\sum_{i} FC_{i,m,y}.NCV_{i,y}.EF_{CO2,i,y}}{EG_{m,y}}$$

Where,

$FEEL_{,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	= Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)

$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,I,y}$	= CO_2 emission factor of fossil fuel type I in year y (tCO_2/GJ)
$EG_{m,y}$	= Net quantity of electricity generated and deliveres 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 relevant year as per the data vintage chosen in Step 3

Step 5. Identify the group of power units to be included in the build margin (BM)

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

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

In the report of DNA, it was found that the most recent constructed five units do not comprise 20% of the system generation; hence option b) was chosen. In this report, the list of power plants that comprise 20% of the generation i.e. over 16,514GWh is reported. 16 units are in the list, with the earliest one being commissioned in March 2004.

In terms of vintage of data, Option 1 (*ex-ante*) shall be chosen for the proposed project. Details are as follows: for the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor shall be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period shall be used. This option does not require monitoring the emission factor during the crediting period.

Step 6. Calculate the build margin emission factor (*$EF_{grid,BM,y}$*)

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

Equation 7: $$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

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

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) will be determined as per the guidance in step 4 for the simple OM, using option A1.

Step 7. Calculate the combined margin ($EF_{grid,CM,y}$) emissions factor

The combined margin emission factor $EF_{grid,CM,y}$ is calculated as follows:

Equation 8: $EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM}$

Where:
w_{OM} Weighting of OM emissions factor (%)
w_{BM} Weighting of BM emissions factor (%)

According to "Tool to calculate the emission factor for an electricity system (version2)" the following default values are used for the proposed project: w_{OM} = 0.5 and w_{BM} = 0.5 will be used for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 will be used for subsequent crediting periods.

Based on above demonstration, DNA of Vietnam has released the emission factor for National grid in 2008 in 26th March 2010. The calculated factor is **0.5764 tCO_2/MWh**[19].

Leakage

The petantially main leakage in the context of the proposed project is emissions arising due to activities such as power plant construction and land inundation. But according to ACM002, version 11 these emissions are neglected.

Emission reductions

Emissions reductions are calculated as follow:

Equation 9: $ER_y = BE_y - PE_y$

[19] DNA reference document
http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_vnHe%20so%20phat%20thai.pdf .

Where:

ER_y	= Emission reductions in year *y*
BE_y	= Baseline emission reduction in year y
PE_y	= Project activity emission in year *y*

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

Data / Parameter:	$1.FC_i$
Data unit:	Varies according to type of fuel
Description:	Amount of fuel i used to generate power in the Viet Nam National Grid used to calculate the OM
Source of data used:	Viet Nam DNA
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No further comments

Data / Parameter:	2. NCV_i
Data unit:	GJ/ unit
Description:	Net Calorific Value (energy content) per mass or volume unit of fuel i used to generate power in the Viet Nam National Grid used to calculate the OM
Source of data used:	Viet Nam DNA
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No further comments

Data / Parameter:	3. EF_i
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per unit energy of fuel i used to generate power in the Viet Nam National Grid used to calculate the OM.
Source of data used:	IPCC 2006
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods	Emission factor of fuels is not available in Viet Nam. As such IPCC default values must be used and considered the best approximation for Viet Nam.

and procedures actually applied :	
Any comment:	No further comments

Data / Parameter:	4. $GEN_{j,y}$
Data unit:	GWh
Description:	The electricity generated by power plants by source j.
Source of data used:	Viet Nam DNA
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No further comments

Data / Parameter:	5. CAP_i
Data unit:	MW
Description:	Newly installed capacity of different fuel types in Viet Nam National Grid
Source of data used:	Viet Nam DNA
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No further comments

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

Project emissions (PE_y)

The proposed project activity involves the construction of a new hydropower plant in an existing reservoir, with no change in the volume of reservoir; thus the project emission is zero: $PE_y = 0$

Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y}.EF_{grid,CM,y}$$

Where: $EG_{PJ,y}$ = 67817 MWh;
$EF_{grid,CM,y}$ = 0.5764 tCO_2/MWh

Therefore

BE_y = 39,090 tCO_2

Emissions reduction *(ER_y)*

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y = 39{,}090 \text{ } tCO_2/year$$

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

The estimated emission reduction of the project activity is provided in Table below.

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2011 (Jul.1st –Dec.31st)	19,545
2012	39,090
2013	39,090
2014	39,090
2015	39,090
2016	39,090
2017	39,090
2018	39,090
2019	39,090
2020	39,090
2021 (Jan.1st – Jun.30th)	19,545
Total estimated emission reductions (tCO_2e)	**390,900**
Number of the fixed crediting years	**10**
Annual average over the crediting period of estimated reductions (tCO_2e)	**39,090**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year y
Source of data to be used:	Project activity site
Measurement procedures (if any)	Power meters comply with local industry standards. The electricity will be measured continuously and monthly report will be generated.
Monitoring frequency:	Continuouslymeasurement and at least monthly recording
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity
Any comment:	Data shall be archived for 2 years following the end of the crediting period.

B.7.2. Description of the monitoring plan:

The monitoring plan aims to ensure that all the emission reductions can be successfully realised during crediting period, and will be implemented by the project owner

1. Monitoring organization

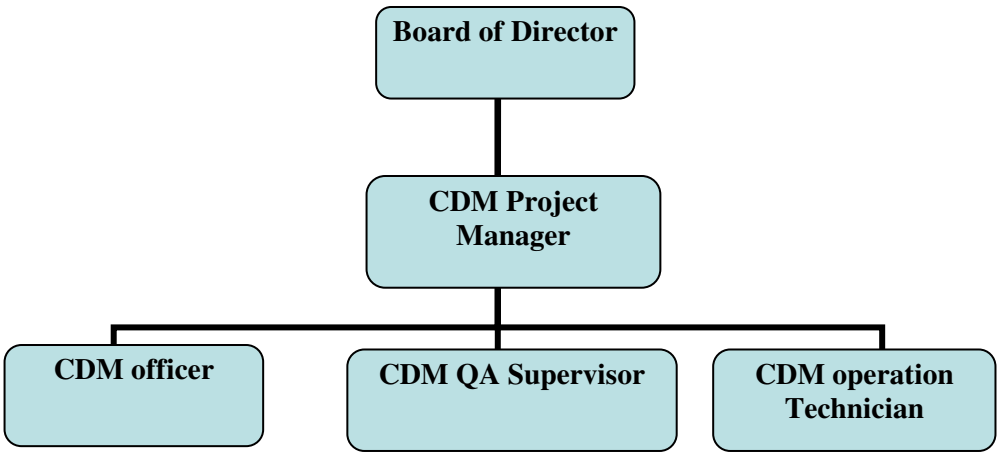

Figure 5: CDM Organization Structure

- CDM Project Manager will be appointed by the Board of Director of Company (Project Owner). The CDM Project Manager is responsible for the overall project management, in full charge of issues related to CDM projects, keeping communication with EB, DNA and related agencies, supervising the project operation status.

- CDM officer is responsible for the whole process of CDM project operation. CDM officer will calculate the CERs and prepare the monitoring report based on the operation data from CDM QA supervisor and CDM operation technician, prepare all relative documentations. He (She) is also responsible for archiving operation data and documents, such as calibration report.

- CDM QA supervisor will verify the operation data collected by CDM operation technician, gather the electricity invoices of sale or other financial receipts, and cross-check the net electricity supplied to the grid.

- CDM operation technician will maintain and calibrate the monitoring equipments to ensure their correct functioning, collect the operation data from the site.

2. Monitoring equipment and installation

2.1 Baseline emission

According to the methodology, following parameter needs to be monitored for baseline emission:

- Net electricity supplied by Nuoc Trong hydropower project ($EG_{facility,y}$)

Monitoring net electricity supply to the power grid ($EG_{facility,y}$)

The accuracy of the electricity meter installed for the project is no less than 1. Two meters will be installed in the proposed project. The first meter is installed in the power plant side, which is used to monitor the power supplied to the grid. The second one is installed at transformer Substation side for backup use (see also in 6).

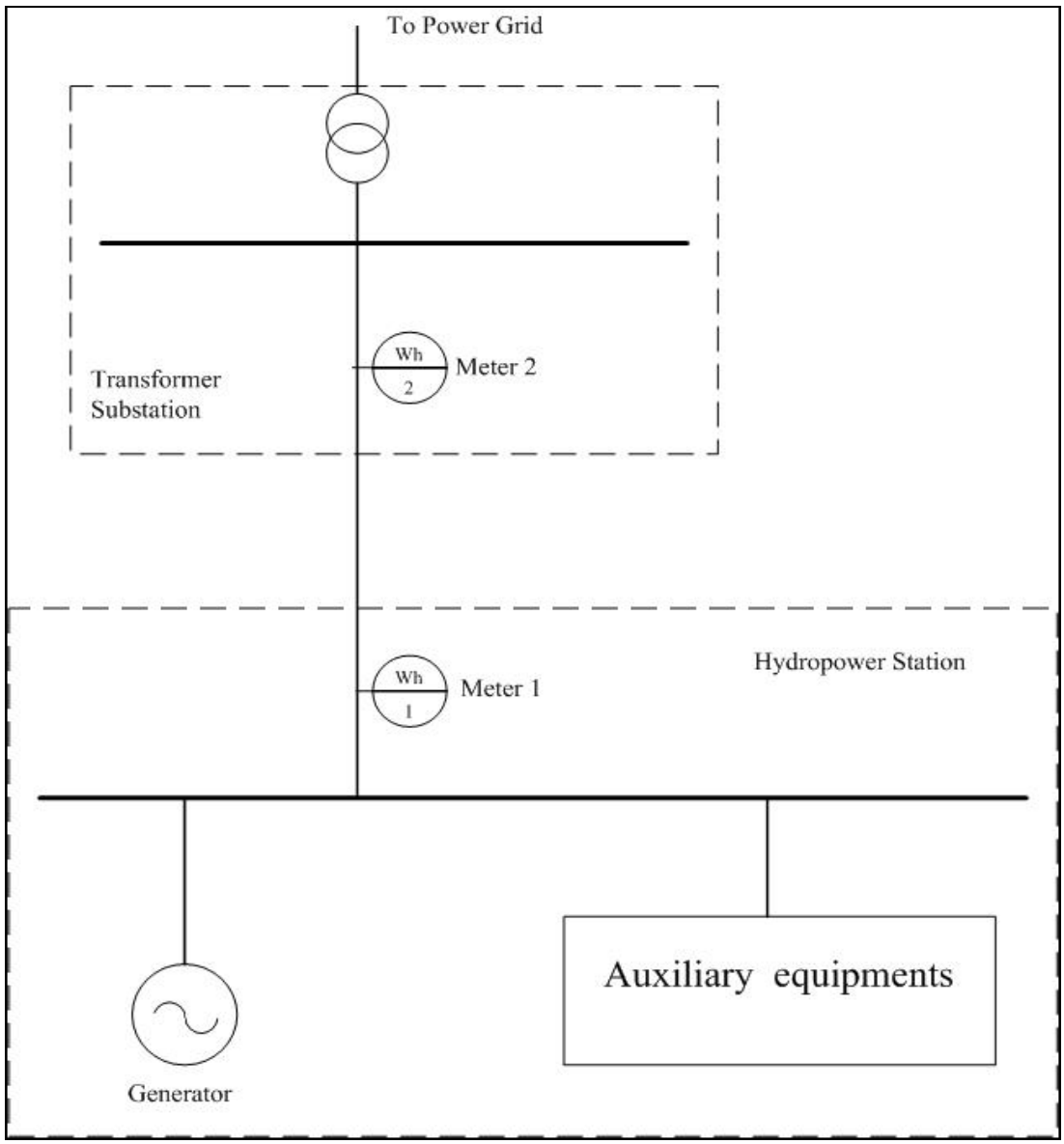

Figure 6: Power Monitoring System

2.2 Project emission

According to the methodology, following parameters need to be monitored for baseline emission:

- Installation capacity ($Cap_{PJ,}$)

Monitoring installation capacity (Cap_{PJ})

Installation capacity of the proposed project activity will be checked according to the equipment nameplate.

3. Calibration & Maintenance procedures

Procedures should be implemented in accordance with national standards, industrial standards or the manufacture's instructions. Guidelines of the calibration procedures are available in the Monitoring Manual.

All the power meters of monitoring system will be calibrated at least once per year by a qualified third party, and the calibration reports will be available to DOE. The calibration procedures will be carried out according to related industry standards.

4. Error Handling Procedure and Corrective Actions

If the reading of the measure meters is not precise, out of allowed ranges, or if the function of meter is abnormal, the amount of electricity that is connected to the grid will be back-up as follows:

(1) First, read data from the back-up meter, calculate the amount of project-generated electricity connected to the grid, except if either Party believes that the back-up meter is not precise after checking;

(2) If the back-up meter is not acceptable, the project owner and power grid company should design a reasonably conservative method to estimate the reading together, and explain how it's reasonable and conservative to the DOE during the Verification site visit.

5. Data management

The management of data records should be undertaken as follows: All data collected shall be kept both in soft copy and archived at the end of every month, and printed and saved as hard copy documents. All electricity sell/purchase invoices shall also be kept. Other hard copy documents, such as maps, forms, the EIA report, etc., should be used to support the monitoring plan to check the authenticity of data. In order to expediently obtain the relevant documentation and all project information for the Verification DOE, the project owner shall provide an index of relevant materials and monitoring reports. All hard copy data and information should be kept in the archives by the CDM group, and all documents should have one copy as back-up. All data should be saved for 2 years after the crediting period.

6. Training

Training includes technical training and CDM training. The technical training focuses on principles and basics of maintenance and repair, power generation operation. CDM training includes an introduction to the CDM and its reporting requirements and procedures.

All staff involved in any of the procedures related with the proposed project will be trained before the start of the crediting period in order to perform the tasks specified in the monitoring plan.

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: 01/09/2010

Name of persons determining the baseline study and monitoring methodology:

Contact Information of the responsible person	**Is organisation a Project Participant *Yes/No***
Cui Junlian, Le Van Hiep Camco International Limited Floor 14, Lucky Tower A, No. 3 North Road, East 3rd Ring Road, Chaoyang District, Beijing, China 100027 Tel: (86 10) 8448 1623 Fax: (86 10) 8448 2432 email:cui.junlian@camcoglobal.com. levan.hiep@camcoglobal.com Website: www.camcoglobal.com	Yes

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:

1/05/2008 [20]

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

20 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:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

[20] The construction contract signing date for proposed project is considered to be the starting date of the proposed project.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/06/2011 or the date for registration, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

Nuoc Trong hydropower project is an integrated component of Nuoc Trong reservoir poject. The approved objectives of this project are:

- Supply water for agriculture land in the dry season,
- Supply water for living of some areas,
- Reduce flood and
- Generate electricity

Nuoc Trong reservoir project was approved by Prime Minister on 11th August 2005 and Hydropower plant component was assigned for Quang Ngai Provincial People Committee to select the investor.

The Environmental Impacts Assessment (EIA) of Nuoc Trong Reservoir project included the impacts from Hydropower plant was ratified by Quang Ngai Provincial People Committee.

Because Nuoc Trong hydropower project only has main works, i.e. constructing power plant behind the dam and connecting lines to the national grid, the own impacts of the project on the environment are minor, which are mainly the impacts during construction period and annual operation. Also, these impacts were included in the EIA of Nuoc Trong reservoir project.

The summary of the environment impacts of Nuoc Trong reservoir project and the solutions to mitigate such impacts are given below:

Activities of project impact on Natural resources and environment	Impacts on Natural resources and environment	Level of impact				Solutions to minimize impacts
		Big	Avarage	Small	No impact	
Impacts relating to the selection of the project						
Flood of land, emigrant, re-location	Impact on the stability of social	x				Plan to properly carry out and plan
Destroy valuable eco-system	Loose of valuable genes				x	Plan and have the solution to conserve
Destroy of cultural, historical values	Loose of cultural, historical values				x	
Underground water	Change underground		x			

	water regime near reservoir, banks of river, basin of reiver					
Impacts relating to design						
Errosion because of road construction, clear up of bed-reservoir	Change of water quality and nutrients of the reservoir		x			Be careful in designing, constructing. Clean up the bed-reservoir before accumulating water
Different rights in using water	Social conflict		x			Keep education and the human-right for people, proper operation
Impacts relating to the construction of the project						
Impede of the river, construct the dam	Impact on transportation by river and the natural immigration of fish			x		Replace the transportation method. Conserve valuable species
Errosion and the flow of sludge and sand	Change the quality of soil and water	x				Proper construction, strictly follow regulated request
Safety, sanitation and health of workers	Strictly control the health of workers		x			Guarantee safe solutions and good conditions for health system
Environmental impacts in operating and exploiting						
Change the flow of lower section	Impacts on transportation by river, errosion, river banks, and change water quality	x				Change trasportation, reinforce important places and limit impacts
Impact on ecosystem of rever mouth	Loose nutrients, increase salt content in dry season				x	
Errosion of valley and sides of reservoir	Reduce lifespan of reservoir	x				Do forestation in the upper section of the river
Inspection of operation and exploit	Social conflict, waste of electricity, water		x			Manage and inspect the operation properly, invest good facilities
Impacts on flood prevention and electricity generation						
Conflict of flood prevention and electricity generation	Difficult in preventing flood and waste electricity			x		Proper operating and exploiting regime Suitable equipments
Transmission lines and pump station	Impact on natural resources of places				x	

	they go through					
Supply electricity for rural areas	Improve living conditions but be easy for accidents				x	Keep education, improve knowledge about using electricity of local people

In brief, the impacts of Nuoc Trong hydropower project were assessed in the EIA report of Nuoc Trong reservoir project. Its impacts on environment, if any, are minor and are subjected with proper solutions to minimize them.

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:

Not applicable.

SECTION E. Stakeholders' comments

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

In order to realize the opinions of local government, communities and citizens who will be affected by the construction of the project, a public consultation was carried out in August 2007. Questionnaires were distributed and collected. The results of the questionnaires are summarized below.

The questionnaire included the following contents:

- Do you think the proposed is important? (Very important; Important; Not important; No idea)
- Do you support the Project? (Yes; No; Unconcerned)
- Which aspects of the proposed project do you think will affect your life: (Air pollution; Water pollution; Noises; Insignificant affect)
- What do you think about the proposed project's impacts on the local area's ecological environment (Improvement; Destruction; No impact)
- What do you think about the proposed project's impact on the surrounding environment: (Improvement; Destruction; No impact)
- Are you satisfied with the outlined environmental impact reduction measures: (Satisfaction; Dissatisfaction; uncertain; incomprehension about the measurement)
- What do you think will be the proposed project's impacts on the local area's economic development? (Meaningful; Meaningless; No impact)
- What do you think about the proposed project's impacts on employment in the local area? (Significant; Insignificant; No idea)

E.2.	Summary of the comments received:

The survey had a response rate of 100% (36 questionnaires distributed with 36 effective returns). The following results were obtained after analysis of the returned questionnaires:

1) All of the respondents approved of the project, and thought it would improve employment opportunities in the area. 92% of the respondents thought that the proposed project would benefit local economic development.

2) 50% of the respondents thought that the proposed project would improve the ecological environment while 47% of them thought it would not impact the ecologic environment. 50% of the respondents thought that the proposed project would improve the surrounding environment while 47% of them thought it would have no impact on it. 75% of the respondents were satisfied with the framed policy for reducing the impacts on the environment, 3% of them were not satisfied with it.

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

The local government and residents support the proposed project. According to the collected comments from local stakeholders, it is not necessary to make any adjustment to the current design, construction plan and operation of the proposed project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project activity

Annex 3

BASELINE INFORMATION

Baseline information released by Vietnam DNA can be referred at the following web adress:

http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_vnHe%20so%20phat%20thai.pdf

The main data used in this report to calculate emission factor of Vietnam national grid are given below:

Electricity generation of power plants (2004-2008)

Group of plant	2004	2005	2006	2007	2008
Hydropower	17,859	16,365	19,508	22,385	25,934
Coal thermal power	6,500	7,872	8,989	9,836	10,055
Gas turbine	19,053	24,017	26,543	29,475	33,857
Oil thermal	1,379	1,612	1,044	1,834	1,482
Diesel using FO	68	50	80	105	90
Diesel using DO	43	16	25	42	15
Baggase	34	26	34	42	36
Imported electricity	39	373	937	2,629	3,220
Total domestically generated electricty	44,936	49,958	56,223	63,719	71,469
Total domestically generated electricity and imported electricity	44,975	50,331	57,160	66,348	74,689

Fuel consumption, emission and electricity generation in 3most recent years (2006,2007,2008)

Group of power plants	Fuel consumption (Coal, oil: ktonnes, Gas: mm^3)	Electricity amount connected to the grid	Emissions (tCO_2)
2006			
Coal power thermal	5,645.86	8,989,230	11,823,610
Gas Turbine		26,542,978	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
Tail gas	0	7470,632	0
Oil power thermal	397.65	1,043,991	1,327,593
Diesel using FO	16.60	80,000	51,642
Diesel using DO	6.39	25,000	20,495
Imported electricity		937,000	0
Total		**37,618,119**	**25,702,918**
2007			
Coal power thermal	6,386.09	9,836,548	13,272,897
Gas Turbine		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	557880	545394
Tail gas	0	8893447	0
Oil power thermal	614.06	1,834,409	2,046,368
Diesel using FO	25.15	104,626	79,867
Diesel using DO	9.16	42,000	29,088
Imported electricity		2,629,000	0
Total		**43,921,501**	**28,544,283**
2008			
Coal power thermal	6,483.99	10,055,394	13.378,811
Gas Turbine		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
Tail gas	0	11,277,816	0
Oil power thermal	534,59	1,481,880	1,784,825
Diesel using FO	22.48	90,465	71,385
Diesel using DO	3.73	15,000	11,879
Imported electricity		3,220,000	0
Total		**48,719,874**	**29,963,699**

Total emission and electricty generation of 3 most recent years

	2006	**2007**	**2008**	**Total**
Total electricity 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**

OM emission factor of 2008

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

Calculation of BM emission factor in year 2008

Plant	**Operation year**	**Fuel consumption (Coal, oil: ktonnes, Gas: mm^3)**		**Electricity to the grid**	**Emission (tCO_2)**
Group of 5 newest plants being constructed					
A Vuong	2008	Hydropower		168,103.50	
Tuyen Quang	2008	Hydropower		1,136,112.18	
Dai Ninh	2008	Hydropower		1,145,108.50	
Nhon Trach	2008	Gas	166.38	544,808.60	378,023
Camau 1&2	2007	Gas	647.24	2,106,807.24	1,431,048

		Tail gas		2,728,872.00	
Total				**7,829,812.02**	
Group of newest plants being constructed contributing 20% of total electricity generation					
A Vuong	2008	Hydropower		168,103.50	
SROC Phu Mieng IDICO	2006	Hydropower		241,566.00	
SE SAN 3A	2006	Hydropower		394,895.70	
Tuyen Quang	2008	Hydropower		1,136,112.18	
Dai Ninh	2008	Hydropower		1,145,108.50	
SESAN 3	2006	Hydropower		1,131,614.00	
Quang Tri	2007	Hydropower		250,804.40	
Uong Bi 2	2007	Coal	281,579	532,000.00	581,017.63
Na Duong	2005	Coal	532	627,930.00	883,846.37
Cao Ngan	2007	Coal	526	708,693.00	1,081,145.84
Formpsa	2004	Coal	495	560,295.00	1,291,302.96
Nhon Trach	2008	Gas	166.38	544,808.60	378,023
Camau 1&2	2007	Gas	647.24	2,106,807.24	1,431,048
		Tail gas		2,728,872.00	
Phu My 2,2	2004	Gas	1,159.75	4,141,980.00	2,510,751.14
Dam Phu My	2006	Gas	56.15	4,716.00	133,868.48
Cai Lan-Vinashin	2007	FO	22.48	90,465.01	71,384.99
Total				**16,514,761.12**	**8,362,286.09**
Result of the calculation of BM emission factor					
Total emission			8,362,386.09 (tCO_2)		
Total electricity generation			15,514,761.12 (MWh)		
BM_{2008}			**0.5064 (tCO_2/MWh)**		

Emission factor (EF) (Combined margin –CM) in 2008

	Weight	**Emission factor (tCO_2/MWh)**
OM	0.5	0.6465
BM	0.5	0.5064
CM (EF)		**0.5764**

Annex 4

MONITORING INFORMATION

Details of the monitoring information can be seen as follows:

A. Description of technical equipment

The metering system will be installed at the connecting point in 35kV Nuoc Trong Station. They are digital meters bi-directly with the accuracy of at least 0.5 S.

The meter type used is an electronic 3 phase and details on the technical equipment can be found in the hard copy document "Technical explaination for metering system" as developed by the project proponent and approved by EVN.

Power metering equipment should be collocated and installed according to "Technical Design for Electric Metering System" for Nuoc Trong Hydropower plant. Before the power metering equipment puts into operation, EVN should check and keep it. Each terminal block of these equipments are sealed with lead to prevent all the unallowable intereferences.

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