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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Title: Dak Pone Hydropower Project

Version: 2.2

Date: 29/11/2010

A.2. Description of the project activity:

The project activity involves the construction of two small-scale sub hydropower plants including Dak Pone hydropower plant and Dak Pone - Expansion hydropower plant with an installed capacity of 14 MW and 1.6 MW, respectively. They are located on the Dak Pone and Dak Ne rivers in Mang Canh and Dak Long communes, Kon Plong district, Kon Tum province of Viet Nam.

Prior to the implementation of the project activity, there is no power generation existing at the project location. Electricity in Vietnam is generated mainly from fossil fuel sources and is solely distributed to consumers via the unique national electricity grid.

The project's purpose is to generate hydroelectricity from a clean and renewable source (hydropower of the Dak Pone and Dak Ne rivers) to supply to the national grid via a Power Purchase Agreement (PPA) signed with the Electricity Corporation of Vietnam (EVN). The total installed capacity of the plants is 15.6 MW and estimated annual gross power generation is 69,100[1] MWh. The net electricity generated (with an estimated annual volume of 68,409[2] MWh) will be supplied to the national grid via a newly constructed 22 kV double-transmission line with a length of 5.58 km.

The baseline scenario of the project activity is the same as the scenario existing prior to the start of implementation of the project activity.

The project activity will generate renewable power with negligible GHG emissions, which will displace part of the electricity otherwise supplied by fossil fuel fired power plants. The project involves the construction of two reservoirs with area of 1.0 ha[3] for Dak Pone hydropower plant and 5.0 ha[4] for Dak Pone – Expansion hydropower plant, with the power density of 1.400 W/m^2 and 32 W/m^2, accordingly. As the power density of this project is above 10 W/m^2, no GHG emissions from the reservoirs need to be accounted in the project activity. Thus, GHG emission reductions can be achieved via this proposed project activity. Total expected CO_2 emission reduction is 241,790 tCO_2 over the first crediting period of 7 years.

The project's contributions to the sustainable development of the local area as well as the host country are as follows:

General contributions towards national sustainable development:

- In recent years, Vietnam, especially the North of Vietnam, has suffered a critical electricity shortage as a consequence from rapidly increasing demand and insufficient supply, thereby

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[1] Feasibility Study Report for Dak Pone hydropower plant and Dak Pone – Expansion hydropower plant
[2] The gross power generation subtracts 1% for parasitic and loss load.
[3] Feasibility Study Report for Dak Pone hydropower plant
[4] Feasibility Study Report for Dak Pone hydropower plant

imposing negative impacts on economic growth as well as on daily lives of people. This project activity will be a contribution towards balancing the supply and demand gap. By exporting electricity directly to the National grid, it will help to reduce electricity losses across the national grid and to lessen the risks of cascading national grid collapse due to overload.

- Modern and highly efficient turbines and generators are being used in the project and the power transmission will be at high voltage to ensure low losses. The project will accelerate the deployment of renewable energy technologies in Vietnam.

Contributions towards local sustainable development:

a) Economic well-being

Once commissioning, this proposed project will increase the industrial share in the economic structure of Kon Tum province – a poor mountainous province of Vietnam. This proposed project will pay annual tax t an average of 7.90 billion VND to the local budget, accounting for about 0.172 % of GDP in 2007 of Kon Tum province[5].

By supplying a stable electricity output, this project activity will facilitate the industrialisation process of the province and leverage the performance of traditional trade villages as well as tourism industry and services inside the province.

b) Social well-being

This project activity will contribute directly to improve the low-quality infrastructure systems of the Mang Canh and Dak Long communes. The communes are categorised as mountainous commune with thin population, less developed and autarky agricultural economy. The majority of local residents living in the project area are from the ethnic minorities like Se Dang, Mo Nam, Ka Dong and Ho Re. They usually live in less favourable living conditions than those of Kinh ethnic – the majority of population in Vietnam. Thus, the project will contribute to improve their living standard that will fill the gap in development between different ethnic groups in Vietnam.

The project will upgrade roads that then will be well integrated into the traffic system of the commune. The project will construct a new 22 kV transmission line together with Dak Pone hydropower plant to export electricity to the national grid. The commission of Dak Pone and Dak Pone – Expansion hydropower plants will contribute indirectly to reducing electricity losses and improving the electricity quality supplied in the region thanks to the stable and new electricity source supplied by the project to the national grid.

The communication system and clean water treatment serving for workers of the project during the both construction and operation phases will be shared with local people. Besides, the project activity could result in the employment of the local people for the construction and operation later on. Therefore, this project activity will contribute directly to alleviate poverty in the region.

This demonstrates that the project activity will contribute positively towards sustainable development and that it is consistent with the energy policies set by the Government[6] of Vietnam.

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[5] Total GDP in 2007 of Kon Tum province quoted from Statistical Annual Book of Vietnam published by Statistical Publishing House 2008

[6] To encourage the investment in exploitation of renewable resources in Viet Nam, the project "Strategies and master plans for energy in Viet Nam for the period up to 2015 with the perspectives up to 2025" is being implemented by the Ministry of Trade and Industry since 2007. This will re-affirm the government policies towards the exploitation of renewable energy but no specific support will be likely given to any specific project idea

Therefore, it satisfies the sustainable development criteria for CDM projects set by the DNA of Vietnam.

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)
Vietnam (host)	PC3 – Investment Joint Stock Company	No
Vietnam (host)	Energy and Environment Consultancy Joint Stock Company	No
Switzerland	Vietnam Carbon Assets Ltd.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the 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):

Socialist Republic of Viet Nam

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

Kon Tum province

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

Mang Canh and Dak Long communes, Kon Plong 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 Dak Pone hydropower plant and Dak Pone – Expansion plant which are located on the Dak Pone and Dak Ne rivers in Mang Canh and Dak Long communes, Kon Plong district, Kon Tum province. This project has co-ordinates as follows:

Project site:

Plant	Coordinates			
	Dam		Power house	
	Northern latitude	Eastern longitude	Northern latitude	Eastern longitude

Dak Pone	14^{0}34’24’’	108^{0}18’19’’	14^{0}34’00’’	108^{0}18’21’’
Dak Pone - Expansion	14^{0}36’49’’	108^{0}17’53’’	14^{0}37’07’’	108^0 17’27’’

The site of the project is showed in Figure 1:

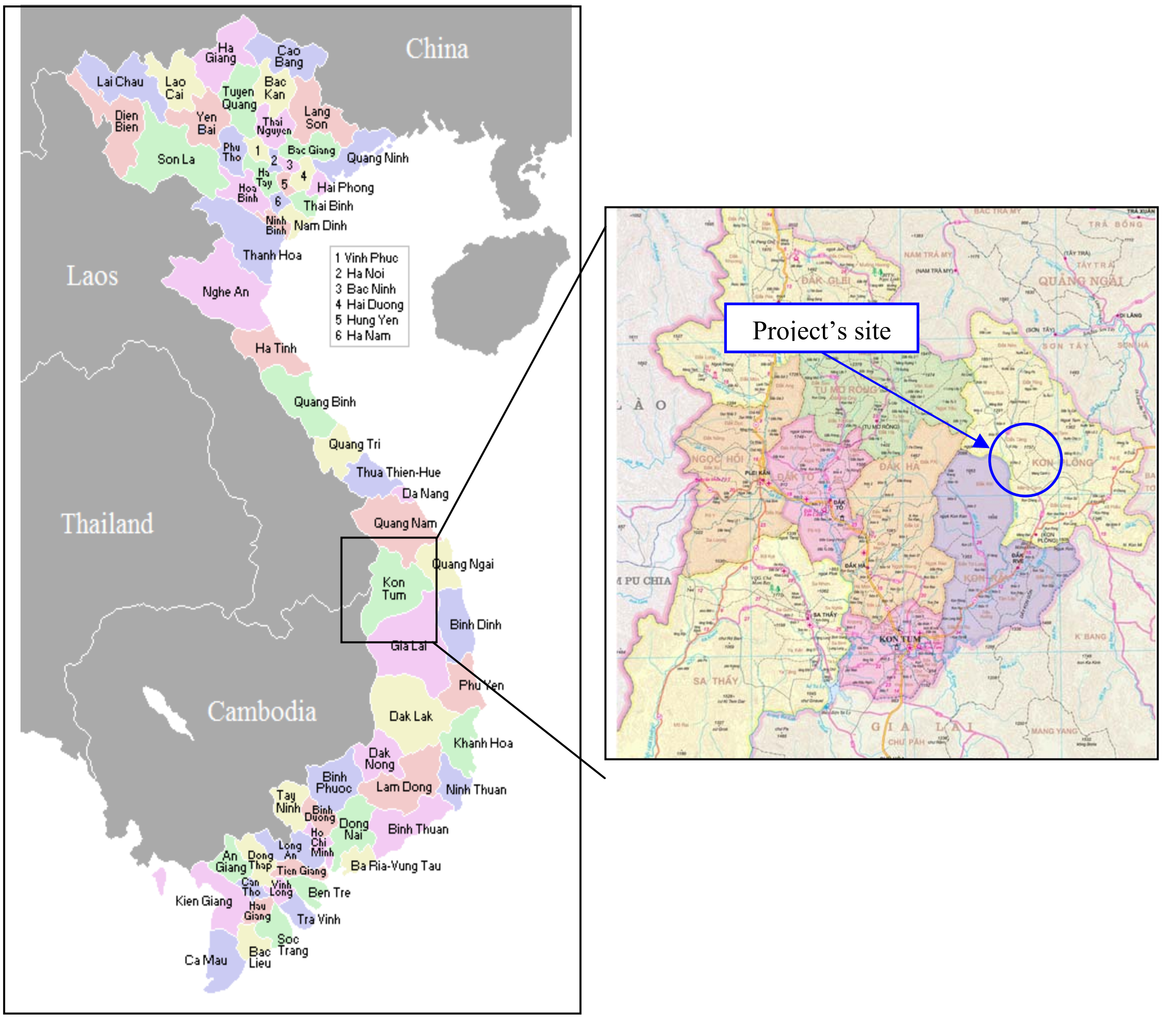

Figure 1: Map of the location of the project activity

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

Sectoral scope/ Category: Energy industries (renewable sources)

Grid-connected electricity generation from 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 (for more information see Annex 3) 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. 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.

The project activity involves the construction of a hydropower plant with two sub- plants. Each sub-plant involves the construction of a dam, canal intakes, tunnels, pressurized wells, penstocks, power house with 2 units and discharge channels in order to convert potential flowing energy from the Dak Pone and Dak Ne streams into clean electrical energy. Electricity generated from both sub-plants will be supplied to the national grid at the connection point through a unique transmission line. At the connection point, the power meter systems will be installed. They are digital and bi-directional type to measure the export and import electricity of Dak Pone Hydropower plant and Dak Pone – Expansion hydropower plant.

Electricity generated from the plants will be supplied to the national grid at the connection point through transmission lines. At the connection point the power meter systems will be installed. They are digital and bi-directional type to measure the export and import electricity of Dak Pone and Dak Pone Expansion hydropower plants.

The metering system includes the main system and back-up systems, each system includes: current transformers (CTs), voltage transformers (VTs) and power meters which are met the IEC or equivalent standard.

- Current Transformers (CTs) are used for measurement of electric currents. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments (power meters).
- Voltage Transformers (VTs) are used in power systems to step-down extra high voltage signals and provide low voltage signals either for measurement
- Power meters are used to combine the current and voltage signal from CTs and VTs to measure the electrical power. More detail about the power meter are described in Annex 4

The project activity involves the construction of two reservoirs with their power density parameters both above 10 W/m^2. According to Version 12 of ACM0002, no GHG emissions from the reservoirs need to be accounted in the project activity.

Figure 2 shows the layout of the project.

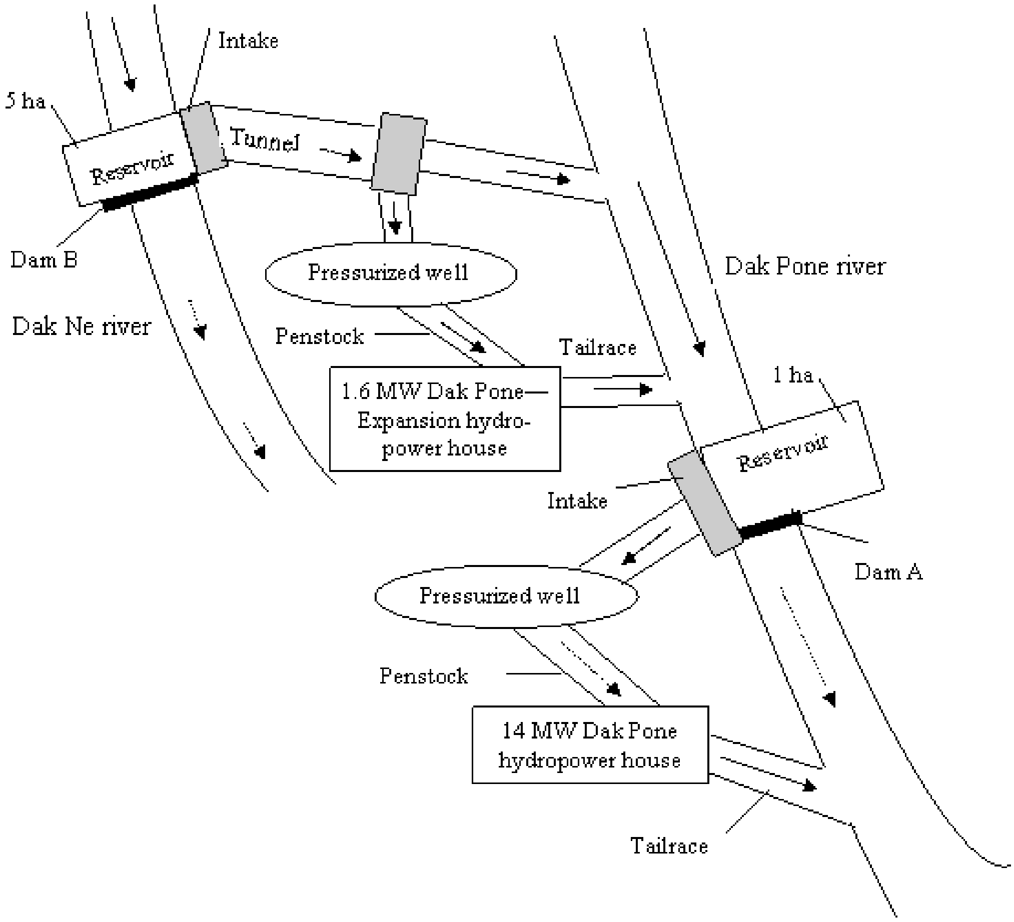

Figure 2: Project lay-out

The main technical parameters of the Dak Pone and Dak Pone – Expansion hydropower plants are shown in Table 1.

Table 1: Main technical parameters of the proposed project activity

Main parameters	Units	Values	
		Dak Pone	Dak Pone - Expansion
1. Turbine			
• Type		Pelton, vertical axis	Francis with Horizontal shaft
• Diameter of runner	m	1.45	0.5
• Rated net head	m	227.75	75.3
• Number of turbine	set	02	02
• Turbine discharge	m^3/s	3.63	1.27
• Efficiency	%	90.5	90.2
• Capacity	MW	7.292	0.847
• Speed	rpm	428.6	1000
• Annual utilisation hours	hour	4492	3881
• Expected lifetime[7]	hour	150,000	150,000
2. Generator			
• Number	set	02	02
• Type		Synchronous, 3 phases, vertical axis	Synchronous, 3 phases, horizontal shaft
• Rated voltage	kV	6.3	6.3
• Rated capacity	kW	7,000	800
• Efficiency at 100% load, Cosφ = 0.8	%	96	94.4
• Expected lifetime[8]	year	30	30
3. Transformer			
• Number	set	02	02
• Type		3 phases, 2 windings	3 phases, 2 windings
• Primary voltage	kV	6.3	6.3
• Secondary voltage	kV	24	24
• Expected lifetime[9]	year	30	30
4. Annual river flow	m^3/s	4.8	1.7

The main equipments utilized in Dak Pone – Expansion Hydropower plant is imported. The contract for "supply of materials, equipment and power house construction design" No. 0905/ PC3-DEC/DAKPONE dated 08 September 2005 to supply mechanical equipment and technical service package for Dak Pone Hydropower plant was signed with Dong Fang Electric Corporation, China. The supplier was chosen via tender.

The project owner will incorporate with equipment supplier – Dong Fang Eletricity Corporation to provide technical service such as training courses for the operation of Dak Pone hydropower plant.

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[7] Default lifetime in EB 50, Annex 15

[8] Default lifetime in EB 50, Annex 15

[9] Default lifetime in EB 50, Annex 15

The main equipment utilized in Dak Pone – Expansion Hydropower plant are imported. The project owner chose supplier via tender. The tender documents set criteria for supplier to ensure that the turbines and alternators shall be state-of-the-art technology.

The baseline scenario of this project activity is identical to the existing scenario mentioned above.

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

The project activity will achieve GHG emission reduction by replacing part of power generated by fossil fuel fired plants connected to the national grid. The projects will apply for a seven-year crediting period, renewable twice up to a total of 21 years. The estimated emission reductions of the first crediting period are presented in Table below.

Table 2: Emission reduction of the proposed project during the first crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2011 (from March to December)	26,482
2012	34,915
2013	34,915
2014	34,915
2015	34,915
2016	34,915
2017	34,915
2018 (from January to February)	5,818
Total estimated reductions (tonnes of CO_2 e)	**241,790**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**34,541**

Table 3: Emission reduction of Dak Pone sub-hydropower plant during the first crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2011 (from March to December)	26,482
2012	31,778
2013	31,778
2014	31,778
2015	31,778
2016	31,778
2017	31,778
2018 (from January to February)	5,296
Total estimated reductions (tonnes of CO_2 e)	**222,446**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**31,778**

Table 4: Emission reduction of Dak Pone – Expansion sub-hydropower plant during the first crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2011 (from March to December)	0
2012	3,137
2013	3,137
2014	3,137
2015	3,137
2016	3,137
2017	3,137
2018 (from January to February)	522
Total estimated reductions (tonnes of CO_2 e)	**19,344**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**2,763**

A.4.5. Public funding of the project activity:

No public funds from Annex I countries is involved in this 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 electricity 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 the demonstration and assessment of additionality"
- Version 02 of "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

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

This proposed project activity is a grid-connected renewable power generation that is then eligible to apply Version 12 of ACM0002. More details of the comparison of the projects' characteristics and the applicability criteria as specified in, Version 12 of ACM0002 is given in Table below:

Table 5: Comparison of project's characteristics and eligibility criteria of Version 12 of ACM0002

Applicability conditions in Version 12 of ACM0002	Characteristics of the project activity	Applicability criterion met?
This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The project activities are installing the new grid connected renewable power plants at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant)	Yes
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The project activities are the installation of two new sub-hydropower plants.	Yes
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 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 plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	The project activities are the installation of two new sub-hydropower plants.	Not applicable
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 • The project activity results in new reservoirs and the power density of the power plant is greater than 4 W/m^2	The project activity constructs two reservoirs The project activity constructs two new reservoirs The power density of the Dak Pone reservoir is 1400 W/m^2 and Dak Pone Expansion reservoir is 32 W/m^2	Not applicable Not applicable Yes
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy sources at the site of the project	It is a renewable energy project with no fuel-switch involved.	Yes

activity, since in this case the baseline may be the continued use of fossil fuels at the site;		
This methodology is not applicable to the biomass fired power plants;	The project activities are hydropower plants.	Yes
This methodology is not applicable to hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	The power density of the Dak Pone reservoir is 1400 W/m^2 and Dak Pone Expansion reservoir is 32 W/m^2. All of them are above 4 W/m^2.	Yes

This comparison shows clearly that Version 12 of ACM0002 is applicable to the proposed project activity.

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

According to Version 12 of ACM0002, the spatial extent of the project boundary includes the Dak Pone, Dak Pone - Expansion hydropower plants and all power plants connected physically to the national electricity grid to which the proposed projects are also connected.

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

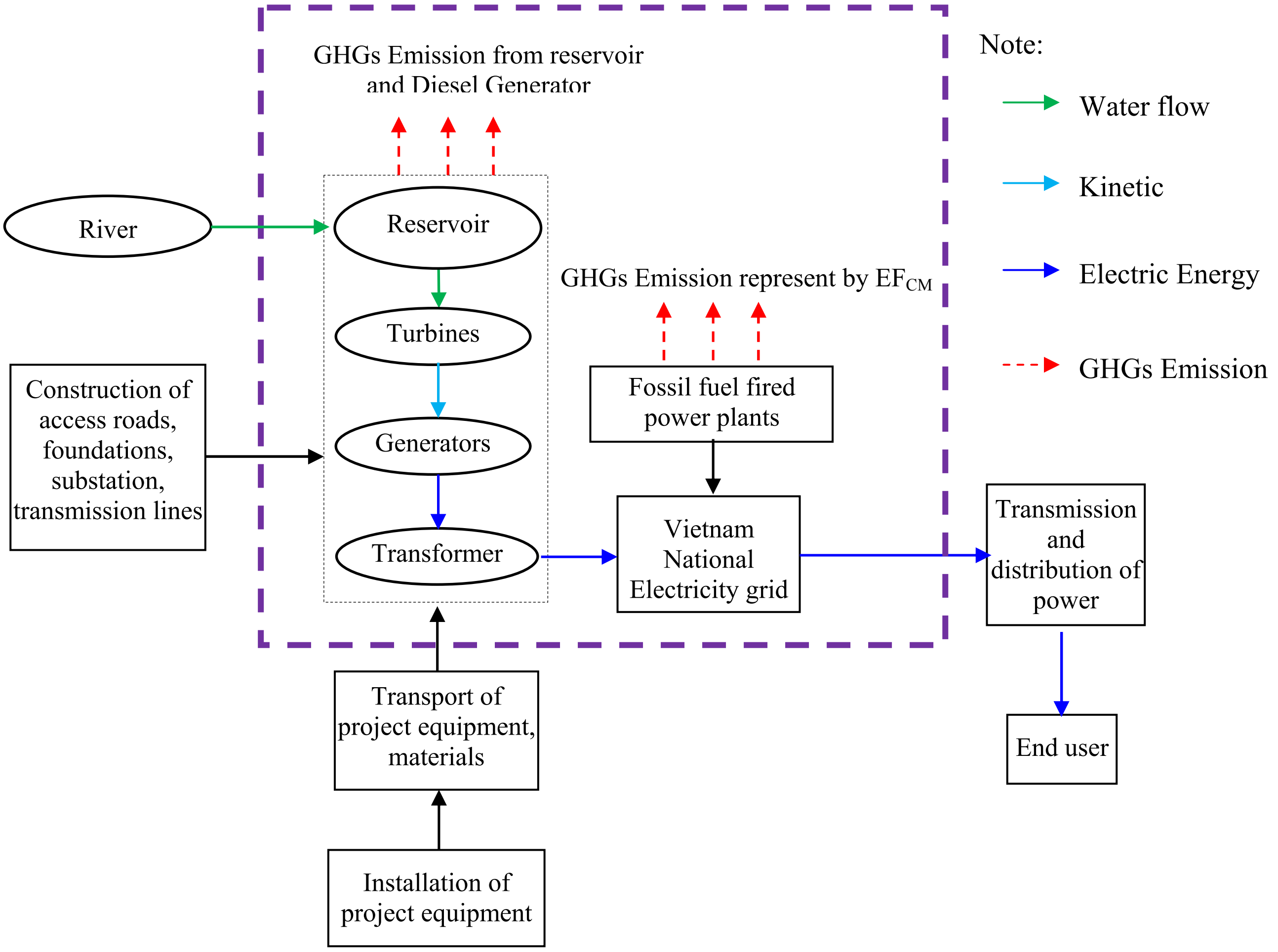

Figure 3: Project boundary

The GHGs and emission sources included in the project boundary are shown in Table below.

Table 6: Sources and gases included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 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	Minor emission source
		N_2O	No	Minor emission source

Project Activity	Emissions of CH_4 from the reservoirs	CO_2	No	Minor emission source
		CH_4	No	As the power density of the projects is greater than 10 W/m^2 CH_4 emissions are neglected according to ACM0002.
		N_2O	No	Minor emission source
	CO_2 emissions from backup power generation	CO_2	Yes	Main emission source. The volume of emission is estimated based on the operation hours of the backup system, and the volume and type of fossil fuel consumed by the backup system in year *y*. The accurate emission is monitored and calculated de factor in year *y*
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

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

According to Version 12 of ACM0002, if the project activity is the installation of a new grid-connected renewable power plant, 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 calculations described in the "Tool to calculate the emission factor for an electricity system".

The Vietnam national electricity grid, which is operated and monopolized by the EVN and is the unique transmission and distribution line, to which all power plants in Vietnam are physically connected is the project electricity system.

Thus the baseline scenario of the proposed project is the delivery of equivalent amount of annual power output from the Vietnam national grid to which the proposed project is also connected. The database for calculating the baseline is provided by EVN.

The analysis and description in B.5 and B6 will support the baseline scenario shown above.

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):

According to Version 12 of ACM0002, the latest version of the "Tool for the demonstration and assessment of additionality" shall be used to demonstrate the additionality of this project activity. Version 05.2 of the additionality tool includes the following steps:

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 alternatives to the project activity will be considered:

Alternative 1: The proposed project activity undertaken without being registered as a CDM project activity.

The construction and operation of Dak Pone and Dak Pone – Expansion hydropower plants with the total installed capacity of 15.6 MW, without being registered as a CDM project activity.

Alternative 2: Adding a new fossil fuel-fired power plant with equivalent power output

The construction and operation of a new fossil fuel power plant

Alternative 3: Adding a new renewable energy power plant other than hydropower plant

The construction and operation of another renewable power plant (e.g. solar, wind, biomass).

Alternative 4: Continuation of the current situation

In this case, the project activity will not be constructed and the power will be solely supplied from the Vietnam national grid.

Alternative 2 cannot be the baseline scenario because 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[10], which is the latest publicly information source listed all operated and planned power plants in Viet Nam, there is not any fossil fired power plant with the equivalent and lower power output is constructed/under construction and/or planned in Viet Nam or Kon Tum province. According to the Electricity Law, the investment in electricity generation must be in line with the list proposed at the latest 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 due to the economic scale. It shows that the investment and operation of thermal power plants with the capacity equal and below 15.6 MW is not realistic in Viet Nam[11].

Alternative 3 cannot be the baseline scenario because the project location does not provide sufficient renewable resources except for the water resource[12].

Besides, in Viet Nam the most popular of renewable technology is hydropower because this technology has been developed in Vietnam since 1964 by commissioning the first hydropower plant namely Da Nhim. The technology for other renewable project is not common practice because at time of decision making there is only one sugar plant which salvaged the biomass (biogases or residue from their process) for electricity generation[13].

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[10] Decision 110/QD-TTg dated 18 July 2007

[11] For a comprehensive list of thermal power plants in Vietnam in English, please also see “Environmental issues of thermal power plants” presented by Dr. Hoang Duong Tung, Vietnam Environmental Protection Agency, Ministry of Natural Resources And Environment at the “Cleaner Coal Workshop on Solutions to Asia's Growing Energy and Environmental Challenges”, 19-21 August 2008, Ha Long City, Vietnam, accessible at: http://www.egcfe.ewg.apec.org/publications/proceedings/CleanerCoal/HaLong_2008/Day%202%20Session%201C%20-%20Huang%20Duong%20Tung%20Environmental%20Issues.pdf

[12] Chapter VI - Master Plan VI

[13] http://www.bourbontn.com/vn/?content=sbook&view=14#book_27 and data supplied by the Institute of Energy

Sub-step 1b: Enforcement of applicable laws and regulations

All alternatives mentioned above are theoretically technically feasible and comply with Vietnamese current laws and regulations. However, Alternative 2 and 3 are not realistic and credible alternatives as explained above.

Hence, Alternative 1 and 4 are further considered as realistic and credible alternative.

Step 2: Investment analysis

Sub-step 2a: Determine appropriate analysis method

The proposed project activity generates financial and economic benefits other than CER revenues, so the simple cost analysis (Option I) is not applicable. Out of the two remaining options, as there are no other credible and realistic baseline scenario alternatives other than electricity supply from the grid, Option II is also not applicable. Thus, the benchmark analysis (Option III) is chosen to prove additionality.

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

In the following, Project IRR is used to demonstrate the Additionality of the project. Provided that the proposed project is financed by **both equity and loan** sources, the appropriate benchmark is WACC which represents the weighted average of the costs of various sources of financing in the financing structure. This benchmark represents the minimal required Project IRR of the project to be economically attractive. The WACC benchmark is indicated in para 12, Annex: Guidance on Assessment of Investment Analysis, Annex 58, EB 51, "*Local lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR*". Thus the project participant applies the following WACC equation to estimate the *required return on capital* as a benchmark for this project IRR:

$$WACC = \frac{E}{V} * R_e + \frac{D}{V} * R_d * (1 - T_c) \quad (1)$$

Where:

R_e : cost of equity

R_d : cost of debt

E : Amount of equity in the project

D : Amount of debt in the project

V : Total investment cost (=E + D)

T_c : average enterprise tax rate

This WACC is the "*the cost of financing and required return on capital*" which is "*based on private equity investors/fund"* required return on comparable projects" as presented in Option III, Item (6)(b) of "*Tool for the demonstration and assessment of additionality*" version 5.2

And it also reflects a common-practice approach in investment decision-making in Viet Nam as this approach was also introduced by the Ministry of Industry to conduct the financial analysis of IPP projects in Viet Nam[14]

Determine the cost of debt

The cost of debt is the interest rate for a long-term loan prevailed at the time of making the investment decision. According to the Annual Report of the State Bank of Viet Nam the local commercial lending rate is 12.6% per year (or 1.05% per month) for commercial medium-term and long-term loan rate in rural area[15]. This report is published at the website of the State Bank annually (*www.sbv.gov.vn/)*.
This value is conservative as it is lower than the lending rate of 13.6% per annum for medium term in 2005 published by the IMF[16]
The applied cost of debt is 12.6% at the date of making the investment decision.

Determine the cost of equity

To derive an appropriate cost of equity for electricity generation project type in Vietnam, the following well-known CAPM[17] standard formula, which describes the relationship between risk and expected return, is employed:

$$R_e = R_f + \beta * (R_{m,} - R_f) \qquad (2)$$

Where:

$R_{e,}$	cost of equity for electricity generation project type
R_f	Risk free rate return
β	Beta of the security for electricity generation project type
$R_{m,} - R_{f,}$	Market risk premium

Risk free rate:

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks, therefore the rate of interest on government bonds are considered as risk free rates. Accordingly the risk free rate has been taken from long term Vietnamese government bond rates available at the date of making the investment decision. The data on government bond rates is published on Ha Noi Stock Exchange website.

The risk free rate applied is 9.00% for 15 years term[18].

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[14] Decision No. 2014/QĐ – BCN issued by the Ministry of Industry provides temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects.

[15] State Bank of Vietnam, ANNUAL REPORT 2OO4, page 47

[16] IMF Country Report No. 07/386, page 24

[17] In finance, the **Capital Asset Pricing Model (CAPM)** is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systemic risk or market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset.

Beta:

Beta (β) indicates the sensitivity of the company to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. For companies that are not publicly listed like PC3-Invstment JSC, the beta is determined by referring to beta values of publicly listed companies that are engaged in similar types of business.

However, at the time of making the investment decision, there was only one company in power sector of Vietnam which was listed in the stock market for 4 month. So the beta for power generation sector could be determined from other companies in emerging countries which have the similar economic conditions as Vietnam.

According to the source from Bloomberg[19], the beta of electricity generation companies in emerging countries are in the table below

Table 7: Betas of similar companies in power generation sector.

No.	Name	Bloomberg symbol	Primary Exchange	Beta
1.	AES TIETE SA	GETI3 BZ Equity	Sao Paulo	0.33
2.	ANHUI WENERGY CO LTD	000543 CH Equity	Shenzhen	1.02
3.	BEIJING JINGNENG THERMAL-A	600578 CH Equity	Shanghai	1.17
4.	CENTRAL COSTANERA S.A.-B 1VT	CECO2 AR Equity	Buenos Floor	0.67
5.	CEZ AS	CEZ CP Equity	Prague-SPAD	1.06
6.	CHONGQING JIULONG ELECTRIC-A	600292 CH Equity	Shanghai	1.04
7.	CIA ENERGETICA DE SAO PAULO	CESP3 BZ Equity	Sao Paulo	0.91
8.	DALIAN THERMAL POWER CO –A	600719 CH Equity	Shanghai	0.99
9.	DATANG INTL POWER GEN CO-H	991 HK Equity	Hong Kong	1.29
10.	EDEGEL SA-COMUN	EDE PE Equity	Lima	0.37
11.	ELECTRICITY GEN PUB CO-FOR R	EGCOMP/FTB Equity	Bangkok	0.94

[18] http://www.hastc.org.vn/Thongtin_Giaodich.asp?actType=1&menuup=402000&TypeGrp=1&MenuId=114000&StockType=1&IssuerID=674

[19] http://www.stern.nyu.edu/~adamodar/pc/archives/emergcompfirm04.xls

12.	ELECTRICITY GENERATING PCL	EGCOMP TB Equity	Bangkok	0.83
13.	EMPRESA ELECTRICA PEHUENCHE	PEHUEN CI Equity	Sant. Comerc	0.63
14.	ENERCHINA HOLDINGS LTD	622 HK Equity	Hong Kong	1.39
15.	FUJIAN MINDONG ELECTRIC PWR	000993 CH Equity	Shenzhen	1.00
16.	GUANGDONG ELEC POWER DEV-A	000539 CH Equity	Shenzhen	0.88
17.	GUANGDONG ELECTRIC POWER-B	200539 CH Equity	Shenzhen	0.97
18.	GUANGDONG SHAONENG GROUP-A	000601 CH Equity	Shenzhen	0.85
19.	GUANGXI GUIGUAN ELECTRIC-A	600236 CH Equity	Shanghai	0.96
20.	GUANGZHOU HENGYUN ENTERPR-A	000531 CH Equity	Shenzhen	0.86
21.	GUODIAN CHANGYUAN ELECTRIC	000966 CH Equity	Shenzhen	1.02
22.	HARBIN SHIRBLE ELECTRIC-A	600864 CH Equity	Shanghai	0.87
23.	HENAN YUNENG HOLDINGS CO-A	001896 CH Equity	Shenzhen	1.05
24.	HUADIAN ENERGY CO LTD -A	600726 CH Equity	Shanghai	1.04
25.	HUADIAN ENERGY CO LTD –B	900937 CH Equity	Shanghai	0.99
26.	HUADIAN POWER INTL CORP-H	1071 HK Equity	Hong Kong	1.12
27.	HUANENG POWER INTL INC-H	902 HK Equity	Hong Kong	1.21
28.	HUANENG POWER INTR INC-A	600011 CH Equity	Shanghai	1.05
29.	HUNAN HUAYIN ELECTRIC PWR-A	600744 CH Equity	Shanghai	1.00
30.	INNER MONGOLIA MENGDIAN HUA	600863 CH Equity	Shanghai	1.04
31.	JIANGXI GANNENG CO-A	000899 CH Equity	Shenzhen	1.12
32.	JILIN POWER SHARE CO-A	000875 CH Equity	Shenzhen	0.95
33.	KOGENERACJA	KGN PW Equity	Warsaw	0.82
34.	LA ELECTRICIDAD DE	EDC VC Equity	Caracas	1.35

	CARACAS			
35.	MALAKOFF BHD	MAL MK Equity	Kuala Lumpur	0.79
36.	PARK ELEKTRIK MADENCILIK	PRKTE TI Equity	Istanbul	0.66
37.	QIANJIANG WATER RESOURCES	600283 CH Equity	Shanghai	0.99
38.	RATCHABURI ELEC GEN HODG PUB	RATCH TB Equity	Bangkok	0.86
39.	SARAWAK ENTERPRISE CORP	SRWE MK Equity	Kuala Lumpur	1.17
40.	SDIC HUAJING POWER HOLDING-A	600886 CH Equity	Shanghai	1.00
41.	SHANDONG LUNENG TAISHAN-A	000720 CH Equity	Shenzhen	1.11
42.	SHANTOU ELECTRIC POWER DEVEL	000534 CH Equity	Shenzhen	1.10
43.	SHANXI ZHANGZE ELEC POWER-A	000767 CH Equity	Shenzhen	0.96
44.	SHENZHEN NANSHAN POWER ST-A	000037 CH Equity	Shenzhen	0.91
45.	SHENZHEN NANSHAN POWER ST-B	200037 CH Equity	Shenzhen	0.97
46.	TOP ENERGY CO LTD-A	600780 CH Equity	Shanghai	1.18
47.	TRACTEBEL ENERGIA SA	TBLE3 BZ Equity	Sao Paulo	0.92
48.	ZHEJIANG SOUTHEAST ELEC-B	900949 CH Equity	Shanghai	0.92
Average beta				**0.97**

So the applied beta is 0.97

Risk Premium:

The most common approach for estimating the risk premium is to base it on historical data. In the CAPM model, the premium is estimated by looking at the difference between average return on stocks and the risk free rate return. The average return on stocks is defined as the compounded annual return.

Table 3: Market expected return calculation

Market index (VN Index) on 28-Jul-2000	100.00
Market index (VN Index) on 14- Feb-2005	235.3
No. of years	4.55
Expected Return	20.73%

Substituting

R_f = 9.00%;

R_m = 20.67%;

β = 0.97

in (2), we get the **cost of equity for this type of these projects in Viet Nam at the date of decision making of the proposed project** as follows:

$$R_e = 20.32\%$$

This rate of the cost of equity for power generation sector meets the EB rules because it reflects a sector specific approach. It is calculated based on similar companies operating in power generation sector therefore it reflects "*standard in the market, considering the specific characteristics of the project type (…)*" as stipulated in the guidance given in the latest additionality tool under sub-step 2b (5).

In addition, Ibbotson Associates, Inc. - a leading provider of independent investment research in major international markets has been published an annual "International Cost of Capital Perspectives Report" since 2001 that also provides a source for the expected rate on return on equity in Vietnam from an investor's point of view. In the report the costs of capital for Vietnam are displayed[20]. In total the report gives 12 different values for Vietnam (due to different calculation methods and investors background). The lowest value among all 12 values given in the report in 2004 is 20.87 %. Since this value is higher than the return on equity 20.32% calculated by CAPM for power generation projects in Viet Nam, 20.32% is applied as the expected rate on return on equity for the benchmark calculation.

Another survey by a securities company in Viet Nam recommends the range of 25% to 30% for cost of equity for power generation companies in Vietnam market[21]. Therefore, **the rate of 20.32% applied as the cost of equity for power generation projects in Viet Nam at the date of decision making of the proposed project is the most conservative value.**

The table below presents key assumption to calculate the benchmark - WACC according to formula (1).

Table 9: Key assumptions to calculate the benchmark

No	Parameter	Unit	Value		
			Total project	Dak Pone – 14MW	Dak Pone – Expansion
1	Total investment cost	billion VND	288.8	258.0[22]	30.8[23]

[20] The referenced report has been updated annually since 2001. The report that was published in May 2005 includes the data up to March 2005 and was available and valid at the date of the decision to implement the project activity. As the report includes proprietary information of the publisher, all relevant details of the report as well as the exact source have been submitted directly to the DOE for validation.

[21] The report by Anpha Securities Company has been submitted to the DOE.

[22] Feasibility Study Report of Dak Pone hydropower plant

[23] Initial FSR of Dak Pone-Expansion hydropower plant

2	Project equity[24]	billion VND	86.6	77.4	9.2
3	Required return on equity rate[25]	%	20.4	20.4	20.4
4	Debt				
	• Total	billion VND	202.1	180.6	21.5
	• Interest rate[26]	%	12.6	12.6	12.6
5	Average enterprise revenue tax[27]	%	22.75	22.75	22.75
6	**Benchmark - WACC**	**%**	**12.91**	**12.91**	**12.91**

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

The key assumptions used to calculate the Project IRR of the proposed project are presented in Table below:

[24] Decision No. 709/QĐ – NLDK issued by the Ministry of Industry to provide temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects.
[25] The cost of equity for power generation project in Viet Nam at the date of decision making of the proposed project is calculated by CAPM
[26] Page 47, The annual report of State Bank of Viet Nam, 2004 Report
[27] Government Decision No 164/2003/ND-CP on implementation of enterprise tax law issued on 22 December 2003, Chapter V: Article 38 – Item 4.

Table 10: Key assumption for investment analysis

No	Parameter	Unit	Value		
			Dak Pone CDM project	Dak Pone -14MW	Dak Pone Expansion
1	Gross capacity[28]	MW	15.6	14	1.6
2	Annual net electricity generation[29]	GWh	68.4	62.3	6.1
3	Total investment cost[30]	billion VND	288.7	258.0	30.8
4	Total annual O&M cost[31]	billion VND	2.88	2.58	0.3
5	Preparation and Construction period[32]	year	2.5	2.5	2.5
6	Period of financial assessment[33]	year	40	40	40
7	Fair value[34]	billion VND	0	0	0
8	Electricity price[35]	VND/kWh	599	599	599
9	Resources tax[36]	%	2	2	2
10	Enterprise revenue tax[37] • For the first 4 years • For the next 7 years • For the remaining years	%	0 14 28	0 14 28	0 14 28
11	**Project IRR without CDM**	**%**	**10.11**	**10.31**	**8.39**

This table shows that the Project IRR of the project was lower than the benchmark at the time of decision making which is defined as the date of issuing the Decision on CDM by the Director of the Power Company No. 3 on 14 February 2005.

All financial data are available to the DOE for Validation.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis of the project activity has been conducted to test the robustness of the above calculations. For the analysis the following parameters have been changed as they mainly influence the feasibility of the project activity:

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28 FSR of Dak Pone hydropower project and Initial FS of Dak Pone – Expansion hydropower project

29 The gross power generation subtracts 1% for parasitic and loss load

30 FSR of Dak Pone hydropower project and Initial FS of Dak Pone – Expansion hydropower project

31 Decision No. 709/QD-NLDK issued by the Ministry of Industry to provide temporary guidelines for conducting the economic, financial and investment analysis.

32 FSR of Dak Pone hydropower and Draft FSR of Dak Pone-Expansion hydropower plant

33 Lifetime for financial analysis was based on the lifetime of equipment according to EB 50, Annex 15

34 The project IRR calculations has reflected "the period of expected operation of the underlying project activity (technical lifetime)", so after 40 years, the fair value is no need to be considered according to *"Guidance on Assessment of Investment Analysis" (version 03)*, Annex 58, EB 51: **"or - if a shorter period is chosen - include the fair value of the project activity assets at the end of the assessment period"**

35 The project owner expects that EVN will buy electricity generate from the proposed project activity at this tariff. It is an average of the feed-in-tariff offered by EVN for IPP hydropower plants in Viet Nam

36 Circular No 153/1998/TT-BTC issued on 26 November 1998 by Ministry of Finance

37 Decree No 164/2003/ND-CP issued on 22 December 2003 by the Government - Chapter V: Article 38

- Annual export to the national grid
- O&M cost
- Investment cost
- Feed-in price set by EVN

Table below shows the impact of variations in key factors on the Project IRR.

Table 11: Sensitivity analysis for Total project

No	Parameter	Variation[38]	Project IRR	Likelihoods to happen
1	Annual amount of electricity exported to the national grid	10.00%	11.16%	Lower than the benchmark
		27.24%	12.91%	The probability of a 27.24% increase in annual export to the national grid is very unlikely. This is because the potential hydrology has been surveyed in long term basis. It is concluded that the hydrological condition is not possible to sustain a 27.24% annual increase compared with the current estimation for the entire crediting period. This option shall be discarded.
		-10.00%	9.02%	Lower than the benchmark
2	O&M costs	10.00%	10.03%	Lower than the benchmark
		-100.00%	10.87%	In the case of zero total O&M cost (or 100% decrease of O&M Cost), the project IRR is 10.87% that is still lower than the benchmark.
		-10.00%	10.18%	Lower than the benchmark
3	Investment costs	10.00%	9.19%	Lower than the benchmark
		-22.51%	12.91%	The probability of a 22.51% decrease in the total investment cost is not likely to happen because the inflation, average consumer prices in 2006, 2007 and 2008[39] show an annual increase of 7.5%, 8.3% and 24% respectively. This option shall be discarded. In fact, the total investment of project which has increased in 2007 is 325.7billion VND (the investment cost increases 13%). So this option shall be discarded
		-10.00%	11.20%	Lower than the benchmark
4	Feed in price set	10.00%	11.16%	Lower than the benchmark

[38] ±10% is selected according to the Decision No. 709/QĐ – NLDK issued by the Ministry of Industry, dated 13 April 2004 to provide temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects. It is also common-practice for sensitivity analysis for additionality demonstration. Furthermore, ±10% is also a common practice rate for sensitivity analysis of a CDM project

[39] http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/weoreptc.aspx?sy=1980&ey=2013&scsm=1&ssd=1&sort=country&ds=.&br=1&c=582&s=PCPIPCH&grp=0&a=&pr1.x=77&pr1.y=10

	by EVN	27.24%	12.91%	The probability of a 27.24% increase in feed in tariff annually is very unlikely because the PPA contract will be signed with EVN with a fixed feed in tariff for long term. However it should be comparable with the tariffs applied for other hydropower projects under fixed feed-in tariffs applied for long-term PPAs for other hydropower projects that are around 603.79VND/kWh[40]. This option shall be discarded.
		-10.00%	9.02%	Lower than the benchmark

Table 12: Sensitivity analysis for Dak Pone – 14 MW hydropower plant

No	Parameter	Variation	Project IRR	Likelihoods to happen
1	Annual amount of electricity exported to the national grid	10.00%	11.37%	Lower than the benchmark
		24.90%	12.91%	The probability of a 24.90% increase in annual export to the national grid is very unlikely. This is because the potential hydrology has been surveyed in long term basis. It is concluded that the hydrological condition is not possible to sustain a 24.90% annual increase compared with the current estimation for the entire crediting period. This option shall be discarded.
		-10.00%	9.21%	Lower than the benchmark
2	O&M costs	10.00%	10.23%	Lower than the benchmark
		-100.00%	11.06%	In the case of zero total O&M cost (or 100% decrease of O&M Cost), the project IRR is 11.06% that is still lower than the benchmark
		-10.00%	10.38%	Lower than the benchmark
3	Investment costs	10.00%	9.37%	Lower than the benchmark
		-20.97%	12.91%	The probability of a 20.97% decrease in the total investment cost is not likely to happen because the inflation, average consumer prices in 2006, 2007 and 2008[41] show an annual increase of 7.5%, 8.3% and 24% respectively. This option shall be discarded.

[40] The statistic data of the feed-in tariffs applied for other hydropower projects best available up to the date of submission of the PDD is submitted to the DOE

[41] http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/weoreptc.aspx?sy=1980&ey=2013&scsm=1&ssd=1&sort=country&ds=.&br=1&c=582&s=PCPIPCH&grp=0&a=&pr1.x=77&pr1.y=10

		-10.00%	11.42%	Lower than the benchmark
4	Feed in price set by EVN	10.00%	11.37%	Lower than the benchmark
		24.90%	12.91%	The probability of a 24.90% increase in feed in tariff annually is very unlikely because the PPA contract will be signed with EVN with a fixed feed in tariff for long term. However it should be comparable with the tariffs applied for other hydropower projects under fixed feed-in tariffs applied for long-term PPAs for other hydropower projects that are around 603.79VND/kWh[42]. This option shall be discarded.
		-10.00%	9.21%	Lower than the benchmark

Table 13: Sensitivity analysis for Dak Pone – Expansion hydropower plant

No	Parameter	Variation	Proect IRR	Likelihoods to happen
1	Annual amount of electricity exported to the national grid	10.00%	9.32%	Lower than the benchmark
		50.90%	12.91%	The probability of a 50.90% increase in annual export to the national grid is very unlikely. This is because the potential hydrology has been surveyed in long term basis. It is concluded that the hydrological condition is not possible to sustain a 51.14% annual increase compared with the current estimation for the entire crediting period. This option shall be discarded.
		-10.00%	7.42%	Lower than the benchmark
2	O&M costs	10.00%	8.31%	Lower than the benchmark
		-100.00%	9.19%	In the case of zero total O&M cost (or 100% decrease of O&M Cost), the project IRR is 9.19% that is still lower than the benchmark
		-10.00%	8.47%	Lower than the benchmark
3	Investment costs	10.00%	7.57%	Lower than the benchmark
		-35.47%	12.91%	The probability of a 35.47% decrease in the total investment cost is not likely to happen because the inflation, average consumer prices in 2006, 2007 and 2008[43] show an annual increase of 7.5%, 8.3% and 24%

[42] The statistic data of the feed-in tariffs applied for other hydropower projects best available up to the date of submission of the PDD is submitted to the DOE

[43] http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/weoreptc.aspx?sy=1980&ey=2013&scsm=1&ssd=1&sort=country&ds=.&br=1&c=582&s=PCPIPCH&grp=0&a=&pr1.x=77&pr1.y=10

				respectively.
		-10.00%	9.35%	Lower than the benchmark
4	Feed in price set by EVN	10.00%	9.32%	Lower than the benchmark
		50.90%	12.91%	The probability of a 50.9% increase in feed in tariff annually is very unlikely because the PPA contract will be signed with EVN with a fixed feed in tariff for long term. However it should be comparable with the tariffs applied for other hydropower projects under fixed feed-in tariffs applied for long-term PPAs for other hydropower projects that are around 603.79VND/kWh[44]. This option shall be discarded.
		-10.00%	7.42%	Lower than the benchmark

The sensitivity analysis shows that the project IRR of the project was considerably lower than the benchmark in all cases.

In conclusion, the proposed CDM project activity is unlikely to be financially attractive.

Step 3: Barrier analysis

Not applied.

Step 4: Common practice analysis

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

Government Decree No 45/2001/ND-CP electricity activities and use which was issued on 02 August 2001 and was entered into force 15 days after the issuance date, created a legal basis to allow other entities to invest in and generate electricity rather than only state-owned entities 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 started the construction activities before August 2001 are not subject to this analysis.

To classify the projects listed against the criteria: *similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate* , the most relevant regulations which regulate the legal entities, the investment management procedures, and the technical designs and construction standards for hydropower projects in different scales (Prime's Minister Decision No 176/2004/QD-TTg, Decision of Ministry of Industry - No 3454/QĐ-BCN, Vietnam Construction Code - TCXDVN 285:2002)

[44] The statistic data of the feed-in tariffs applied for other hydropower projects best available up to the date of submission of the PDD is submitted to the DOE

According to Vietnam Construction Code - TCXDVN 285:2002 "Irrigation projects - Major standards on designing"[45], which regulates the criteria for construction contractors, design steps and warranty period for construction works activities, hydropower projects are categorized as follows.

Table 14: Groups of hydropower projects according to Vietnam Construction Code - TCXDVN 285:2002

Group	Installed capacity
I	equal and larger 300 MW
II	equal and larger 50 MW but smaller 300 MW
III	smaller 50 MW but equal and larger 5 MW
IV	smaller 5 MW but equal and larger 0.2 MW
V	up to 0.2 MW

According to the Prime's Minister Decision No 176/2004/QD-TTg, which defines the legal entities against the project scale, private entities are not encouraged to invest in hydropower projects with capacity above 100 MW. Furthermore, according to the Decision of Ministry of Industry - No 3454/QĐ-BCN dated 18th October 2005 defining the jurisdictions to approve the Master Plans and Management hierarchy for small scale hydropower project, hydropower projects having installed capacity within the range 1 MW to 30 MW are categorised as small scale projects.

To serve the purpose of this analysis and in order to categories hydropower projects in correspondence with the existing regulations mentioned above, hydropower projects are categorised into groups as follows:

Table 15: 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
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 and Decision of Ministry of Industry - No: 3454/QD-BCN, Prime's Minister Decision No 176/2004/QD-TTg
E	equal and smaller 30 MW and larger 5 MW	Vietnam Construction Code - TCXDVN 285:2002 and Decision of Ministry of Industry - No: 3454/QD-BCN, Prime's Minister Decision No 176/2004/QD-TTg
F	up to 5 MW	Vietnam Construction Code - TCXDVN 285:2002 and Decision of Ministry of Industry - No: 3454/QD-BCN, Prime's Minister Decision No 176/2004/QD-TTg

According to Table above, this proposed project activity falls into Group E. Table below provides the projects belong to Group E which are similar scale and take place in a comparable environment to the proposed project activity.

[45] Construction Code regulates the basic technical standards that are mandatory for construction activities in Vietnam

Table 16: Hydropower plants in group E[46]

No	Name	Capacity MW	Construction starting year	Commissioning year	Developed as CDM project
1	Nam Mu	12	2002	2004	No
2	Ea Krong Rou	28	2003	2007	No
3	Suoi Sap	14.4	2004	2007	No
4	Nam Tha 6	6.0	2006	2007	Yes
5	Ngoi Xan 1	8.1	2006	2007	Yes
6	Na Loi	9.3	2000	2003	No

Because the Na Loi hydropower project started construction from 2000[47], it is excluded from this common practice analysis. It is also applied to Nam Tha 6[48] and Ngoi Xan 1[49] as they are developed as CDM projects. Thus only 3 projects are relevant in this analysis.

The comparison of the three remaining hydropower plants and the proposed project activity is present in Table below.

Table 17: Hydropower plants which belong to group E (5-≤ 30 MW) were developed in Viet Nam

No	Name	Capacity MW	Elec. outputs 10^3 MWh	Load factor	Construc-tion starting year	Commi-ssioning year	Investor during the investment and construction period
0	**The proposed project**	**15.6**	**69.1**	**50.6**	**2005**	**2010**	**PC3 - Investment Joint Stock Company**
A. Invested and constructed by state-owned companies or joint stock companies which are either state-owned or whose major shares held by the government							
1	Nam Mu	12	55.7	53.0	Jan. 2002	2004	Song Da Construction Corporation - one of the largest state-owned construction corporation belongs to Ministry of Construction (Nam Mu Hydropower JSC was set up on 29th May 2003 to take over the continuing construction and to operate the Nam Mu plant)[50]
2	Ea Krong Rou	28	110.7	45.1	Oct. 2003	2007	Mien Trung Power Investment and Development Joint Stock

[46] Master Plan of Electricity Expansion for period of 2006-2015 with perspective to 2025 - EVN (Master Plan VI)

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

[48] http://cdm.unfccc.int/UserManagement/FileStorage/HWAFNGZRTMU51V86XDB2LP40I79KJE

[49] http://cdm.unfccc.int/UserManagement/FileStorage/ZTSNIRG1O4E8YX3H2WFJD0LBA5KM7Q

[50] Prospectus of Nam Mu Hydropower Joint Stock Company Company http://cafef.vn/hastc/bao-cao-tai-chinh/HJS-cong-ty-co-phan-thuy-dien-nam-mu.chn#taichinh

							Company (Song Da Construction Corporation and Power Company No.3 hold 85% of shares. Power Company No.3 belongs to EVN)[51]. In addition, this project has received ODA loan from India
B. Invested and constructed by private companies							
3	Suoi Sap	14.4	65.7	52.1	Jul. 2004	2007	Truong Thanh Construction Company Limited

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

The existence of these hydropower plants does not contradict the result of the benchmark analysis stating that the proposed project is financially unattractive, because of the following reasons:

- *For projects 1 - 2*: These projects have been invested in by either large state-owned corporations or joint stock companies whose majority shares held by large state-owned corporations. These projects do not face the barriers that the proposed project faces because:
    1. The state-owned corporations mentioned above are among the largest state-owned power and construction corporations in Vietnam. Their operations as well as their investment activities are financed mainly by the state budget. In 1990s, Song Da Construction Corporation have been assigned by the government to invest in and operate national hydropower plants like Hoa Binh - Song Da (1900 MW), Yaly (720 MW), Tri An (400 MW), Ham Thuan (300 MW) and Thac Ba (108 MW). Therefore, they have substantial experiences in designing, investing, constructing and operating hydropower plants.
    2. The state-owned corporations mentioned above were established according to the Prime Minister's Decisions No 90/TTg and 91/TTg dated on 07 March 1994. The formulation of these corporations is to aim at developing power and construction industries in order to meet national socio-economical development goals and strategies and to implement development tasks assigned by their ministries and/or Prime Minister in certain development periods. Therefore, the key target of these corporations is to serve as the governmental tool for macroeconomic interferences rather than profit making.
- *Project 3*: The initial main objective of this project by the government was to invest in an irrigation project to provide water for 700 ha commercial plantation trees and rice fields in order to alleviate poverty and to develop local agriculture and rural communes in Phu Yen District, Son La Province. Then the project owner decided to synergise with the construction of a hydropower plant. This project has borrowed soft-loan from ODA soft-loan from India at a very favourable interest rate[52] while the proposed project has to take loans from domestic banks without such a favourable condition. The circumstances of this project thus clearly show that this project has not been facing a similar barrier as the proposed project.

As can be seen from the above analysis, no similar projects facing the same barriers as the proposeproject have been developed without the aid of CDM.

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[51] http://www.songda.com.vn/info/info.do?info=subCompanyDetail&subCompanyId=122

[52] Source: Interview with Truong Thanh Construction Company Limited and confidential documentation provided to DOE

Implementation timeline of the proposed project activity

At the "CDM business Opportunities for Cogeneration Projects" seminar organised by COGEN 3[53] on 26 October 2004 in Ho Chi Minh City, the PDD of the Dak Pone CDM project was presented. After the event, the project owner continued implementing formal activities to pursue CDM. The decision to apply for CDM for the project was issued on 14 February 2005. This was prior to the starting date of the proposed project activity, which is defined as the date of signing the construction contract of the dam A on 25 February 2005. In this decision, Small and Medium Hydropower Projects Management Unit, one unit under Power Company No.3, was also assigned to implement this hydropower project. In 2008, the PC3 - Investment Joint Stock Company was established based on the Small and Medium Hydropower Projects Management Unit to inherit and continue all investment activities of the proposed project

During the construction of Dam A, the constructor has requested the project owner to approve the increase of workloads and contract values. This approval process has extended the construction period thus the construction of Dam A was completed on 22 December 2007. The construction of the whole project has been taken place from 2005 until 2010 because the final technical design for the power house of the 14 MW Dak Pone was only accomplished in May 2007. During the implementation, the project owner took serious actions to secure the CDM status by sending the CDM application letter to the EVN and the Belgium CDM Programme and negotiating on an official CDM consultancy contract with the local CDM consultant.

Later, the project owner sent official letters to the Kon Tum Department of Natural Resources and Environment (Kon Tum DONRE) requesting for their support to develop the proposed project as a CDM project. Then, the Kon Tum DONRE and the Kon Tum People's Committee (the highest provincial authority) issued official letters to verify and support the CDM project in October 2007. In parallel, the project owner signed the CDM consultancy contract No. 01/HD-CDM/VNEEC-PC3 with VNEEC on 22 October 2007. The LoA was issued on 30 June 2008.

The major milestones in developing the investment project and CDM application are summarized in the table below.

Table 18: Major milestones of Dak Pone in developing the investment project and CDM application

Development of investment project	Actions taken to achieve CDM registration	Time	Implication on CDM
Finalizing the Feasibility Study report of the 14 MW Dak Pone hydropower project		Jun 2004	
Initial FSR of the Dak Pone Expansion hydropower project (1.6MW)		Oct 2004	

[53] COGEN 3 promoted the implementation of Proven, Clean & Efficient Biomass, Coal, Gas Cogeneration Projects by facilitating business partnerships between ASEAN industries and EUROPEAN suppliers. COGEN 3 was in operation in January 2002 to December 2004. The website http://www.cogen3.net/presentationasean.html will be available until 2015.

	The PDD of the investment project was developed and presented in the seminar "CDM business Opportunities for Cogeneration Projects" in Ho Chi Minh city[54]	26 Oct 2004	CDM early consideration evidence
	Issuing the Decision on CDM by the Director	14 Feb 2005	Date of making Investment Decision
Signing the contract for construction of dam A		25 Feb 2005	Start date of the project activity
	Submitting a formal letter by the project owner to the EVN to inform the CDM project and requested for their support	6 Apr 2005	Activity to secure CDM status
	Issuing a formal letter by the EVN to verify the support for the CDM project idea	25 Apr 2005	Activity to secure CDM status
	Submitting a formal letter by the project owner to the EVN to nominate the CDM project to apply for the Belgium CDM programme	31Aug 2005	Activity to secure CDM status
Signing the Contract for supply of materials, equipment and power house construction design for 14 MW Dak Pone hydropower project with DongFang Eletricity Corporation		8 Sept 2005	
Requesting to adjust the contract and contract value for construction of dam A by the contractor (Quang Nam Irrigation & Hydroelectric Construction JSC)	Negotiating the CDM consultancy contract with local consultant	9 Jun 2006	
Finalizing the Feasibility Study report on 1.6 MW expansion Dak Pone hydropower project		12 Mar 2007	
Approving the increase work volume and new budget of Dam A by Power Company 3		11 May 2007	

54 http://www.cogen3.net/presentations/asean/cdm_hcm/PDDsoftwoCDMprojectsinVietnam.pdf

	Submitting a formal letter by the project sponsor to request the local authorities for their verification and support for the CDM project	5 Jul 2007	
Signing the contract for construction of dam B		11 Oct 2007	
Signing the contract for construction of tunnel, pressurized well and others for 14 MW		18 Oct 2007	
	Signing the CDM development and registration contract with the CDM consultant (CDM consultancy contract)	22 Oct 2007	
	Submitting a CDM supporting letter by Kon Tum DONRE	29 Oct 2007	
	Submitting a CDM supporting and verification letter to the DNA by the PPC	30 Oct 2007	
Establishing the PC3 - Investment Joint Stock Company to manage the Dak Pone hydropower project [55]		2 Jan 2008	
Issuing the Certificate of Investment for the 15.6 MW Dak Pone Hydropower project by PPC		4 Apr 2008	
	LOA issued	30 Jun 2008	
	Validation	Mar 2009	
Commissioning date		17 May 2010	

In conclusion, the proposed project is additional.

[55] The initial project owner of project is Power 3 Company however in the Investment decision, the Power 3 Company assigned the Small and Medium Hydropower Management Unit to implement Dak Pone project. On 02 January 2008

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.

I. Project emissions *(PE_y)*

According to the ACM0002 Version 12 , the project emission for the Hydropwer project is:

$$PE_y = PE_{HP,y} + PE_{FC,j,y}$$

In which:

$PE_{HP,y}$: Emission from reservoir:

$PE_{FC,j,y}$: Emission from diesel backup generator

<u>*Emission from reservoir:*</u>

For hydropower project activity that results in new reservoirs and/or the increase of existing reservoirs, the power density (*PD*) of the project activity shall be calculated as follows:

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

Where:

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

If the *PD* is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = \frac{\mathrm{EF_{Res}} \cdot TEG_y}{1000}$$

Where:

PE_y	Emission from reservoir expressed as tCO_2e/year
EF_{Res}	is the default emission factor for emissions from reservoirs, and the default value as per

EB23 is 90 Kg CO_2e /MWh.

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

If *PD* is greater than 10 W/m^2, then:

$$PE_y = 0$$

Emission from diesel backup generator:

The project emission includes the proponent of emission from backup power in emergent situation such as both cut-off of electricity supply from the national grid and the hydropower plant. The following formula is applied according to the "Tool to calculate project or leakage CO_2 emission from fossil fuel consumption":

Emission from the operation of a backup system in process *j* during the year *y* is calculated as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

$$\text{and } COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$PE_{FC,j,y}$	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y*
$FC_{i,j\,y}$	Is the quantity of fuel type *I* combusted in process *j* during the year *y* (mass or volume unit/year)
$COEF_{i,y}$	Is the CO_2 emission coefficient of fuel type *I* in year *y* (tCO_2/mass or volume unit)
$NCV_{i,y}$	Is the weighted average net calorific value of the fuel type i in year y (in this case fuel type is diesel so $NCV_{i,y} = NCV_{diesel,y}$)
$EF_{CO2,i,y}$	Is the weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ), y (in this case fuel type is diesel so $EF_{CO2,i,y} = EF_{CO2,diesel,y}$)
i	Are the fuel types combusted in process j during the year y (in this case is diesel)

II. Baseline emissions *(BE_y)*

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

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

Where:

BE_y	Baseline emissions in year *y* (tCO_2/yr).
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)

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

Calculation of $EG_{PJ,y}$

Because the project activity is the installation of a new grid-connected 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

The Version 02 of "Tool to calculate the emission factor for an electricity system" determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" and "build margin" as well as the "combined margin", including 7 steps as follows:

STEP 1. Identify the relevant electric power system.

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

STEP 3. Select a method to determine the operating margin (OM)

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

STEP 5. Identify the group of power units to be included in the build margin.

STEP 6. Calculate the build margin emission factor.

STEP 7. Calculate the combined margin emissions factor.

Step 1. Identify the relevant electric power system

This hydropower project will be connected to the national electricity grid of Vietnam, which is operated and monopolized by the EVN. This national electricity grid is the unique transmission and distribution line, to which all power plants in Vietnam are physically connected. Hence the national electricity grid is the project electricity system.

There are electricity imports to the national electricity grid from China - another host country, thus the China Power Grid is the connected electricity system and the emission factor for the imported electricity is zero tons CO_2 per MWh by default.

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

There are 2 options in the tools to choose, including:
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.
Because only the data of grid connected power plants is available, so Option I will be chosen for calculating the grid emission factor.

Step 3. Select a 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.

The method (a) can be used in the project because low-cost/must-run resources in Vietnam is 36.08 % that constitute less than 50% of total grid generation in average of the five most recent years (details see the table below).

Table 19: Rate of low cost/must-run sources based on generation[56]

Year	2003	2004	2005	2006	2007	Average
Rate of low cost/must-run sources generation (%)	46.04	38.40	30.90	32.41	32.66	**36.08**

The data vintage which is used to calculation the Simple OM emission factor is the Ex-ante option of a 3-year generation-weighted average (2005, 2006 and 2007) that is 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.

Step 4. Calculate the OM emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants units.

There are 2 Options proposed, including:

Option A: Based on data on the net electricity generation and a CO2 emission factor of each power unit, or
Option B: Based 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.

[56] Source: Appendix 7 of Summation of Operation of National Power System in 2007, EVN, January 2008

Because the necessary data for Option A is available so Option A "*Calculation based on average efficiency and electricity generation of each plant"* is used and then the simple OM emission factor is calculated as follows:

$$EF_{grid,OM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM,y}$	is the Simple operating margin CO_2 emission factor in year *y* (tCO_2/GWh)
$EG_{m,y}$	is the net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (GWh)
$EF_{EL,m,y}$	is the CO_2 emission factor of power unit *m* in year *y* (tCO_2/GWh)
m	All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
y	Either 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)

Because the data on fuel consumption and electricity generation of power unit *m* is available, so the emission factor ($EF_{EL,m,y}$) should be determined as **Option A1** :

$$EF_{EL,m,y} = \frac{\sum_m (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	is the CO_2 emission factor of power unit *m* in year *y* (tCO_2/GWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power plant/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 electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year *y*
y	The relevant year as per the data vintage chosen in Step 3

Table 20: Operating Margin emission factor of the most recent 3 years (2005, 2006 and 2007)[57]

Year	2005	2006	2007	$EF_{grid,OM}$ (tCO_2/MWh)
Total emission of the Vietnam national grid (tCO_2e)	**22,752,237**	**24,753,523**	**26,895,639**	**0.6017**
Total electricity delivered to the grid by fossil power sources (MWh)	**36,701,670**	**40,764,000**	**46,191,700**	

So $EF_{grid,OMsimple,y}$ is derived as follows:

$$\boldsymbol{EF_{grid,OMsimple,y} = 0.6017\ tCO_2/MWh}$$

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

The sample group of power units *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 terms of vintage of data, Option 1 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.

The comparison carried out by the project participants shows that the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) that have been built most recently has the larger annual generation (15,476,442 MWh) than the set of five power units that have been built most recently in 2007 does (1,175,442)[17], and hence it is employed.

Step 6. Calculate the BM emission factor

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

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

[57] Source: Institute of Energy – EVN, 2007 via a data providing contract. The data and source are submitted to the DOE for validation. The Institute of Energy which belongs to the EVN provides the most actually updated data relevant to the power generation in Vietnam that could be accessed by public.

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

Then $EF_{grid,BM,y}$ is derived as follows:

$$\boldsymbol{EF_{grid,BM,y} = 0.4191\ tCO_2/MWh}$$

Step 7. Calculate the combined margin (CM) emissions factor

The CM emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$$

Where:

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

For the proposed project, the following default values are used: w_{OM} = 0.5 and w_{BM} = 0.5 in the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 in the second and third crediting period.

So in the first crediting period, the CM emission factor is derived as follows:

$$\boldsymbol{EF_{grid,CM,y} = 0.5 \times 0.6017 + 0.5 \times 0.4191 = 0.5104\ tCO_2/MWh}$$

The baseline emission factor EF shall be fixed for the crediting period.

III. Leakage *(LE_y)*

According to ACM0002 Version 12, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are neglected, therefore ***$LE_y = 0$***

IV. Emission reductions *(ER_y)*

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	Emission reductions in year *y* (tCO_2e/y).
BE_y	Baseline emissions in year *y* (tCO_2e/y).
PE_y	Project emissions in year *y* (tCO_2/y).
LE_y	Leakage emissions in year *y* (tCO_2/y).

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

Data / Parameter:	$\mathbf{Cap_{BL}}$
Data unit:	MW
Description:	Installed capacity of hydropower plant before the implementation of the project activity.
Source of data used:	This is a green-field project. This value does not exist prior to the implementation of the project activity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project activity constructs a new hydropower plant, so Cap_{BL} is considered by zero according to Version 12 of ACM0002.
Any comment:	For calculating the power density (PD)

Data / Parameter:	$\mathbf{A_{BL}}$
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. For new reservoirs, this value is zero.
Source of data used:	This is a green-field project. This value does not exist prior to the implementation of the project activity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project activity builds a new reservoir, so A_{BL} is considered by zero according to Version 12 of ACM0002.
Any comment:	For calculating the power density (PD)

Data / Parameter:	$\mathbf{FC_{i,m,y}}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data used:	Institute of Energy – EVN, 2008 via a data providing contract

Value applied:	Value applied in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Dispatch data is not disclosed by the Government of Vietnam. The Institute of Energy which belongs to the EVN provides the most actually updated data relevant to the power generation in Vietnam that could be accessed by public.
Any comment:	For calculation of EF_{OM} or EF_{BM}

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	GJ / mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	Institute of Energy – EVN, 2008 via a data providing contract
Value applied:	Value applied presented in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Dispatch data is not disclosed by the Government of Vietnam. The Institute of Energy which belongs to the EVN provides the most actually updated data relevant to the power generation in Vietnam that could be accessed by public.
Any comment:	For calculation of EF_{OM} or EF_{BM}

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Value applied presented in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	With reference to the version 2.0 of "Tool to calculate the emission factor for an electricity system" referred to Version 12 of ACM0002
Any comment:	For calculation of EF_{OM} or EF_{BM}

Data / Parameter:	**$EG_{m,y}$**
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant *m* in year *y*
Source of data used:	Institute of Energy – EVN, 2008 via a data providing contract
Value applied:	Value applied presented in Annex 3

Justification of the choice of data or description of measurement methods and procedures actually applied:	Dispatch data is not disclosed by the Government of Vietnam. The Institute of Energy which belongs to the EVN provides the most actually updated data relevant to the power generation in Vietnam that could be accessed by public.
Any comment:	For calculation of EF_{OM} or EF_{BM}

Data / Parameter:	**$NCV_{diesel, y}$**
Data unit:	TJ/Gg
Description:	Net calorific value (energy content) of diesel in year *y*
Source of data used:	IPCC default value
Value applied:	43.3
Justification of the choice of data or description of measurement methods and procedures actually applied:	With reference to Version 02 of "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Any comment:	For calculation of $PE_{FCj\ y}$

Data / Parameter:	**$EF_{CO2,diesel,y}$**
Data unit:	$kgCO_2/TJ$
Description:	CO_2 emission factor of diesel in year *y*
Source of data used:	IPCC default value
Value applied:	74,800
Justification of the choice of data or description of measurement methods and procedures actually applied:	With reference to Version 02 of "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Any comment:	For calculation of $PE_{FCj\ y}$

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

Project emissions (PE_y)

Emission from reservoir:

The proposed project activity involves the construction of two new hydropower plants with total capacity (Cap_{PJ}) of 15.6 MW and two new reservoirs with total surface (A_{PJ}) of 6 ha, thus A_{BL} = 0 and Cap_{BL} = 0.

The power densities of the project activity are derived as follows:

$$PD_{DakPone} = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{14*10^6 - 0}{1*10^4 - 0} = 1,400(W/m^2)$$

$$PD_{DakPoneExpansion} = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{1.6*10^6 - 0}{5*10^4 - 0} = 32(W/m^2)$$

All power densities are greater than 10 W/m^2, according to Version 12 of ACM0002, the project emission from reservoir is zero. Furthermore, the total electricity generation is no need to monitor because the power densities of the proposed projects are not in range of 4 to 10 W/m^2.

The lowest power of density is greater than 10 W/m^2, thus the project emission is zero: $PE_{HP,y} = 0$

<u>*Emission from diesel backup generators*</u>

The project will employ a diesel motor as backup power for emergency situation, such as both cut-off of electricity supply and the hydropower station. According to the "*Tool to calculate project or leakage CO2 emissions from fossil fuel consumption"*, the annual CO2 emissions from diesel oil combustion are calculated as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

$$\text{and } COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$PE_{FC,j,y}$	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y*
$FC_{i,j\,y}$	Is the quantity of fuel type *I* combusted in process *j* during the year *y* (mass or volume unit/year)
$COEF_{i,y}$	Is the CO_2 emission coefficient of fuel type *I* in year *y* (tCO_2/mass or volume unit)
$NCV_{i,y}$	Is the weighted average net calorific value of the fuel type i in year y (in this case fuel type is diesel so $NCV_{i,y} = NCV_{diesel,y}$)
$EF_{CO2,i,y}$	Is the weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ), y (in this case fuel type is diesel so $EF_{CO2,i,y} = EF_{CO2,diesel,y}$)
i	Are the fuel types combusted in process j during the year y (in this case is diesel)

According to the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, the NCV of diesel oil is 43.3(TJ/Gg), and the emission factor is 74,800 $kgCO_2$/TJ, and thus the $COEF_{i,y}$ = 3.24 $kgCO_2$/kg diesel.

In ex ante emission calculation, the diesel consumption is assumed as zero. Because in a very special case when the generation from the plant is temporarily terminated, diesel back-up generators will be used to generate electricity for internal use in the plant. However, this case rarely happens and is not at any frequency. Even in case it happens, it's expected that it will last during a couple of days only. Furthermore, fuel consumed for the power backup is expected very small. Therefore, the emission from this source is considered very negligible or $PE_{FC,y}$ = 0 *ex ante*.

When $FC_{i,j,y}$ is more than or equal to 107 tons, the project emission of diesel motor is more than or equal to 349 tCO2e, which is 1% of expected annual emission reductions of proposed project, then the project emissions from diesel motor will be accounted in, otherwise, the CO_2 emission from diesel oil combustion is negligible.

Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

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

Where: EG_y= 68,409 MWh; $EG_{baseline}$= 0 MWh; and $EF_{grid,CM,y}$= 0.5104 tCO_2/MWh

Therefore: BE_y = 34,915 (tCO_2)

Leakage (LE_y)

As it is stated in ACM0002 version 12, this emission is considered as zero: $LE_y = 0$

Reduction emissions (ER_y)

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y = 34{,}915 \ (tCO_2/year)$$

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.

Table 21: Emission reduction of the Total project activity

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2011 (from Mar to Dec)	0	26,482	0	26,482
2012	0	34,915	0	34,915
2013	0	34,915	0	34,915
2014	0	34,915	0	34,915
2015	0	34,915	0	34,915
2016	0	34,915	0	34,915
2017	0	34,915	0	34,915
2018 (from Jan to Feb)	0	5,818	0	5,818
Total (tonnes of CO_2 e)	**0**	**241,790**	**0**	**241,790**

The summary of the ex-ante estimation of emission reductions is shown in Table below.

Table 22. Summary of the ex-ante estimation of emission reductions

Parameters	Unit	Value
1. Total installed capacity	MW	15.6
2. Baseline CO_2 emissions		
• The OM	tCO_2/MWh	0.6017
• The BM	tCO_2/MWh	0.4191
• The CM emission factor	tCO_2/MWh	0.5104
3. Total baseline CO_2 emissions over the chosen crediting period	tCO_2	**241,790**
4. Total project CO_2 emissions over the chosen crediting period	tCO_2	0
5. Total leakage CO_2 emissions over the chosen crediting period	tCO_2	0
6. Total CO_2 emission reductions over the chosen crediting period	tCO_2	**241,790**

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
Description:	Net electricity supplied by the proposed hydropower plant to the national grid
Source of data to be used:	Calculating from $EG_{y,\ import}$ and $EG_{y,\ export}$.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	68,409
Description of measurement methods and procedures to be applied:	Calculating by subtracting $\mathbf{EG_{y,\ import}}$ from $EG_{y,export}$. Double checking by the joint balance sheet issued by EVN and project owner to ensure the consistency. Data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	The data will be crosschecked with records for sold electricity.These equipment and systems should be calibrated and checked every 2 year.
Any comment:	For CERs calculation

Data / Parameter:	$\mathbf{EG_{y,\ export}}$
Data unit:	MWh
Description:	Electricity supplied by the proposed hydropower plant to the national grid
Source of data to be used:	Direct measurement at the project connection point
Value of data applied for the purpose of	68,409

calculating expected emission reductions in section B.6	
Description of measurement methods and procedures to be applied:	Two-way power meters will be installed at the grid-connected point to measure the amount of electricity supplied to the grid by the proposed hydropower plant by the positive direction. The readings of electricity meter will be continuously measured by the power meters and monthly recorded. Double checking by the invoice issued by project owner to ensure the consistency. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	The uncertainty level of this data is low. The measurement/ monitoring equipment should adopt the colligated automation system complying with national standard and technology. These equipment and systems should be calibrated and checked every 2 year.
Any comment:	For $EG_{facility,y}$, = $EG_{y, export}$ - $EG_{y, import}$

Data / Parameter:	**$EG_{y, import}$**
Data unit:	MWh
Description:	Electricity supplied by the grid to the proposed hydropower plant
Source of data to be used:	Direct measurement at the project connection point
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be applied:	Two-way power meters will be installed at the grid-connected point to measure the amount of electricity supplied by the grid to the proposed hydropower plant by the reverse direction. The readings of electricity meter will be monthly recorded. Double checking by the invoice issued by EVN to ensure the consistency. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	The uncertainty level of this data is low. The measurement/ monitoring equipment should be complied with national standard and technology. These equipment and systems should be calibrated and checked every 2 year.
Any comment:	For $EG_{facility,y}$ = $EG_{y, export}$ - $EG_{y, import}$

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	Reservoir A: 10,000

for the purpose of calculating expected emission reductions in section B.6	Reservoir B: 50,000
Description of measurement methods and procedures to be applied:	Measured from topographical surveys and maps yearly
Monitoring frequency	Yearly
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**Cap_{PJ}**
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Aggregated from Generators' nameplate at the project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Dak Pone: 14,000,000 Dak Pone Expansion: 1,600,000
Description of measurement methods and procedures to be applied:	This parameters will be check directly in the project site.
Monitoring frequency	Yearly
QA/QC procedures to be applied:	The project owner will assure the originality of nameplates by regularly checking.
Any comment:	For power density calculation.

Data / Parameter:	**$FC_{i,j,y}$**
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type *i* combusted in process *j* during the year *y*
Source of data to be used:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be	Monitor every month according to the plant log book.

applied:	
QA/QC procedures to be applied:	The fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Any comment:	For calculating the PE_y

B.7.2. Description of the monitoring plan:

According to Version 12 of ACM0002, there is no need to monitor project emissions and monitor leakage under this project activity.

Although the lowest of power density of the project is higher than 10 W/m^2, the surface area of the reservoir will be monitored annually. It will be taken by collecting photographic evidence of the surface level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

In addition, volume of fossil fuel consumed for backup power system will be recorded and achieved separately Dak Pone and Dak Pone – Expansion hydropower plants. This data is available before verification process.

The baseline emission factor of Vietnam National Grid ($EF_{grid,CM,y}$) is fixed ex-ante (detail in Section B.6), therefore the main data to be monitored is $EG_{facility,y}$, $EG_{facility,y}$ will be calculated according to this formula below:

$$EG_{facility,y} = EG_{y,\ export} - EG_{y,\ import}$$

The electricity generated from the project activity will be sold to the EVN for the complete project lifetime under a long-term PPA with EVN

The electricity generated from the project activity before entering into the grid at the grid interconnection point will be measured by a digital kilowatt hour (kWh) meter. The metering system will be installed in 22kV block (J13, J15) in 110 kV Kon Plong substation to measure electricity from both Dak Pone hydropower plant and Dak Pone – Expansion power plant. The metering system includes the main system and a back-up system. The back-up system will be used in case of failing of the main meter.

Data from the operating meters will be recorded electronically hourly. Additionally, monthly manual readings will be taken from the operating meters.

Monthly, EVN staff and staff of the operation division of the power plant will cross-check manual meter readings with the electronically recorded data and prepare and sign a protocol of the amount of power fed into the grid since the last protocol/start of operation of the power plant.

This protocol is also the basis of payment by the EVN to the project proponent. Hence, the monitoring plan is well integrated into the standard EVN procedures. When the generation from the plant are cut off, the owner will use the backup diesel generators to generate electricity for internal use in the plant. In such case, the CDM team will keep relevant record for verification process.

For further details see Annex 4.

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: 10/ 03/ 2009
Name of person/entity determining baseline study and monitoring methodology:

Hanh Dang, Energy and Environment Consultancy Joint Stock Company (VNEEC)
Email: dhanh@eec.vn
Tel: + 84 – 4 – 2148810; Fax: + 84 – 4 – 2812733
VNEEC is one of the project participants

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:

25/02/2005

This is date of signing the construction contract of dam A that is the earliest contract signed by the project owner to commit for the project's expenditures. This is in accordance with the "CDM Glossary of Terms/version 05", which define the starting date of project as "the earliest date at which either the implementation or construction or real action of a project activity begins".

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

40 years 0 months

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:

01/03/2011 or date of registration whichever is later

C.2.1.2. Length of the first crediting period:

7 years 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

Pursuant to the Environment Law 1993 of Vietnam and Circular No. 490/1998/TT-BKHCNMT of the Ministry of Science Technology and Environment dated 29 April 1998 on issuance of the guidelines to establish and verify the environment impact assessment report of investment projects, the ***registration report to meet environment standards*** has been carried out for this project The ***registration report to meet environment standards*** has been approved by the Department of Natural Resources and Environment of Kon Tum (Kon Tum DONRE) via the issuance of the Environment Protection Certificate No. 09/PXN-MTg on 20 May 2004 .

Furthermore, based on the impact assessments of the proposed project, the EIA report proposes that the mitigation measures shall be conducted during the construction and operation phases in order to minimize the negative impacts and ensure the long-term benefits from this project.

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

The environmental impacts and mitigation measures are summarized as follows.

1.1. Environment Impacts

1. Impact on land

The proposed projects will occupy about 116.072[58] ha of land for arrangement of project area. There is agricultural area about 21.151 ha, 45.244 ha is the forestry land, and the rest is brushwood or creeper.

2. Impacts on water flow

The project will create two small reservoirs with total area of about 6 ha. The project uses water resources from Dak Pone and Dak Ne rivers. Since the reservoirs regulate water level on the daily basis only but not seasonally, the water flow of Dak Pone and Dak Ne rivers will be affected negligibly in quality and quantity. The content of dissolved oxygen as well as other chemical content as pH, turbidity, etc... will not be changed. The flow regime in the reservoir area as well as downstream areas behind the powerhouse will be more stable which in turn can create favourable conditions for fishery.

Moreover, MONRE issued the license for surface water usage for Dak Pone hydropower plant (No. 1841/GP-BTNMT) on 20 November 2007. This license allows the project owner to use surface water from Dak Pone and Dak Ne rivers for generating electricity.

3. Impacts on ecological system

The Dak Pone hydropower project does not cross-out any natural conservation areas or specialized forest.

In general, according to surveys, fishing activity in this area is not developing. The reservoirs are very small (6 ha), so the impact to ecological system and organism on land are definitely low.

[58] Compensation and land clearing file of Dak Pone hydropower project

4. Impacts on local environment surrounding the construction site

During the construction period, the project's activities such as material exploitation, material transportation, mine explosion, and road construction as well as the concentration of workers will have certain negative impacts on local environments, namely local air and noise pollutions.

However, these impacts are temporary and will be terminated after commissioning the construction phase.

1.2. Socio-economic impacts

1. Negative impacts

The main effect by this project is the occupation 116.072 ha land. These land areas will be compensated adequately according to the governmental regulations. There is agricultural area about 21.151 ha included by this project.

The project will effect to 24 households. No resettlement activity happens in this project.

2. Positive impacts

As presented in Section A.2

1.3. Mitigation measures to reduce negative impacts

1.3.1 Construction phase

- *Waste collection and treatment*
  - Implement regular collection and treatment of solid and liquid wastes, including the construction of a dumping area
  - Conduct reforestation in the temporarily occupied areas and strengthen the slopes to avoid erosions, after accomplishing the construction of main works.
  - Conduct awareness on the environmental protection for workers and local people.
- *Local pollution*
  - Dust removal measures will be taken such as spraying water along the roads.
  - All means/vehicles for transport of construction materials must be covered in order to minimize dust dispersion.
  - All transport equipment/vehicles and machines must have operational certifications issued by the Directorate for Standards and Quality.
- *On socio-economic impacts:*

Implement the compensation plan for the local impacted people according to the government law

1.3.2 Operational phase

Preventive measures and reaction towards environment problems: Install monitoring equipment to monitor absorption and distortion of water rising and water quality released from the plant and propose suitable preventive measures if required.

1.4. Conclusion

The main negative impacts on environment happen due to the construction activities. However, all these impacts will be mitigated by implementing mitigation measures and then will be terminated after accomplishing the construction phase. Preventive and mitigation measures are planned to conduct during the operation period to reduce and prevent any negative impacts.

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:

The following stakeholders have been consulted since the initial stage of forming the investment project idea:

- People Committee of Kon Tum province (highest local authority) supports to develop this project as a CDM project activity in official letter No. 2280/UBND-ND dated 30 October 2007.
- Department of Natural Resources and Environment of Kon Tum province who approved the Environmental Protection Commitment at Letter no 09/PXN-MTg dated 20 May 2004, and sent the request the Kon Tum Peoples' Committee for their verification and support of the CDM project development in official letter No. No 475/STNMT-MT dated 29 October 2007.
- Local people in the project area in Mang Canh and Dak Long commune, Kon Plong district, Kon Tum province on the project implementation and compensation. Stakeholders have been consulted in several steps as follows:
    - Firstly, the meeting with local people to announce the proposed project activity and to collect opinions/feedbacks on the project was held by the project owner and the local authority.
    - Then, each household from 24 households who live in Mang Canh and Dak Long communes having either land and/or vegetations occupied/replaced by the project were invited and filled in surveys to provide statistic data on impacted lands and assets in 2004.
    - After that, the negotiations on the reimbursement with each impacted household were conducted until reaching an agreement for compensation.

In general, there are no disputes in compensation between the local people and the project owner. The local people can directly raise their concerns/interests regarding the compensation with the project owner

or via the local authority who acts as an intermediate to facilitate the communication between the project owner and the local people.

Besides, the local people of Dak Long commune were involved in the CDM consultation process. On 1 August 2007, a meeting between the project owner and the following representatives of the local people were held in order to consult local people on the social-economic and environment impacts of the proposed project in order to develop this project as a CDM activity.

- Commune's People Council: The members of Commune People Council are elected by residents in commune. So the Council opinions officially represent for opinions of the local people.
- Commune's People Committee (CPC): CPC is the lowest administration level in Vietnam administrative hierarchy. Chairman of CPC is elected by the Commune People Council, so he well represents the commune's interest.
- Commune's communist party committee secretary: this is one of the key government bodies in making development strategies at the communal level.
- Village's representative: head of village, secretary of young union, head of farmers' association, head of women's association. Such associations are NGOs and represent the interests of different groups.

E.2. Summary of the comments received:

All organizations agreed that the project will certainly contribute to sustainable development and environment protection in Vietnam and especially this project will increase local budget and reduce poverty. Therefore, they fully support the project to develop under the CDM and recommend the project owner to complete necessary procedures to submit the project to the DNA and to the EB for registration.

Comments of the representatives of local people and local authority are summarized as follows:

- The proposed hydropower project is a clean industrial project and will contribute positively to socio-economic development of the project's area;
- The positive impacts are expected from infrastructure improvement such as road, electricity access, and clean water system.
- The project will contribute to conservation of forest and environmental protection; and
- The local people expect that the project activity will employ local people for construction as well as operation phases if suitable and will minimise negative impacts during the construction phase.
- The local people support the project to develop under the CDM and recommend the project owner to complete necessary procedures to submit the project to the national and international approval bodies

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

To address the requests from local people, the project's owner committed to:

- Use local human resources for appropriate jobs in the construction and operation phases
- Seriously apply and implement mitigation activities as stated in the EIA report in order to minimise negative impacts on local environment.

- Comply with existing regulation on compensations and agreements with households to implement a fair and reasonable plan. The project owner has negotiated and reached an agreement with each impacted households. Then a compensation budget and plan has been approved by the People's Committee of Kon Tum province at the Document No 1128/BCTD-HD on 27 October 2004. The payment to each household in made under the supervision of the Compensation Board which has representatives from government offices and local people

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**PC3 - Investment Joint Stock Company**
Street/P.O.Box:	78A Duy Tan, Hai Chau district, Da Nang city
Building:	
City:	Da Nang
State/Region:	--
Postfix/ZIP:	--
Country:	Vietnam
Telephone:	+ 84 – 0511 - 3212545
FAX:	+ 84 – 0511 - 3622292
E-Mail:	--
URL:	--
Represented by:	Nguyen Luong Minh
Title:	Director
Salutation:	Mr.
Last name:	Nguyen
Middle name:	Luong
First name:	Minh
Department:	--
Mobile:	--
Direct FAX:	
Direct tel:	
Personal e-mail:	--

Organization:	**Energy and Environment Consultancy Joint Stock Company**
Street/P.O.Box:	Room 1210, building 18T2 Trung Hoa – Nhan Chinh, LeVan Luong Street
Building:	--
City:	Hanoi
State/Region:	Hanoi
Postfix/ZIP:	--
Country:	Vietnam
Telephone:	+ 84 – 4 – 2148810
FAX:	+ 84 – 4 – 2812733
E-Mail:	eec@eec.vn
URL:	www.eec.vn
Represented by:	Dang Thi Hong Hanh
Title:	Deputy Director
Salutation:	Mrs
Last name:	Dang
Middle name:	Thi Hong
First name:	Hanh
Department:	--

Mobile:	+ 84 – 917.291.417
Direct FAX:	+ 84 – 4 – 62812733
Direct tel:	+ 84 – 4 – 22148810
Personal e-mail:	dhanh@eec.vn

Organization:	**Vietnam Carbon Assets Ltd.**
Street/P.O.Box:	Technoparkstr.1
Building:	N/A
City:	Zurich
State/Region:	N/A
Postcode/ZIP:	8005
Country:	Switzerland
Telephone:	+41 43 501 35 50
FAX:	+41 43 501 35 99
E-Mail:	info@southpolecarbon.com
URL:	www.southpolecarbon.com
Represented by:	Renat Heuberger
Title:	Managing Director
Salutation:	Mr
Last name:	Heuberger
Middle name:	N/A
First name:	Renat
Department:	N/A
Mobile:	N/A
Direct FAX:	+41 43 501 35 99
Direct tel:	+41 43 501 35 50
Personal e-mail:	registration@southpolecarbon.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from the Annex I parties is involved in the project activity

Annex 3

BASELINE INFORMATION

Value applied: Data of power plants in the Vietnam national grid in 2005, 2006 and 2007[59]

Data for calculating of $EF_{grid, OM, 2005}$

General information			FUEL 1: Main fuel						FUEL 2: Sub fuel						Emission factor
ID(j)	NAME (m)	COM (m)	FUEL (1,m)	FC (1,m,2005)	NCV (1,2005)		EF (CO2,1,2005)		FUEL (2,m)	FC (2,m,2005)	NCV (2,2005)		EF (CO2,2,2005)		EG(m,2005)
ID number of the power plant 'm'	Name of the power plant 'm' serving the grid in year '2005' except low-cost/must-run power plant	Commission date of the whole power plant	Fuel type '1' combusted in power plant 'm' in year '2005'	Amount of fossil fuel type '1' consumed by power plant 'm' in year '2005'	Net Calorific Value (energy content) of fossil fuel type '1' in year '2005'		CO2 emission factor of fossil fuel type '1' in year '2005'		Fuel type '1' combusted in power plant 'm' in year '2005'	Amount of fossil fuel type '2' consumed by power plant 'm' in year '2005'	Net Calorific Value (energy content) of fossil fuel type '2' in year '2005'		CO2 emission factor of fossil fuel type '2' in year '2005'		Net electricity generated and delivered to the grid by the power plant 'm' in year '2005'
-	-	-	-	(Coal, DO, FO: kt; Gas: million m3)	(Coal, DO, FO: kCal/kg Gas: kCal/m3	(Coal, DO, FO: GJ/kt, Gas:GJ/million m3	kg CO2/TJ	tCO2/GJ	-	(Coal, DO, FO: kt; Gas: million m3)	(Coal, DO, FO: kCal/kg Gas: kCal/m3	(Coal, DO, FO: GJ/kt Gas: GJ/million m3	kg CO2/TJ	tCO2/GJ	MWh
1	Phu My 2.1	December 2005	Gas	724	9072	37,983	54,300	0.0543	DO	30.64	10150	42,496	72,600	0.0726	3,640,000
2	Na Duong	November 2005	coal	249	3950	16,538	94,600	0.0946	DO	0.30	10150	42,496	72,600	0.0726	389,000
3	Phu My 2.2	February 2005	Gas	665	9072	37,983	54,300	0.0543	DO	32.74	10150	42,496	72,600	0.0726	3,719,000
4	Phu My 4	July 2004	Gas	537	9072	37,983	54,300	0.0543	DO	28.05	10150	42,496	72,600	0.0726	3,013,000
5	Formosa	April 2004	coal	32	6500	27,214	94,600	0.0946	DO	0.62	10150	42,496	72,600	0.0726	800,000
6	Phu My 3	March 2004	Gas	772	9072	37,983	54,300	0.0543	DO	58.32	10150	42,496	72,600	0.0726	4,442,000
7	Phu My 1	June 1905	Gas	1308	9072	37,983	54,300	0.0543	DO	1.63	10150	42,496	72,600	0.0726	7,171,300

[59] Source: Institute of Energy – EVN, 2008 via a data providing contract. The data and source are submitted to the DOE for validation. The Institute of Energy which belongs to the EVN provides the most actually updated data relevant to the power generation in Vietnam that could be accessed by public.

8	Pha Lai 2	December 2002	coal	2077	4950	20,725	94,600	0.0946	DO	3.32	10150	42,496	72,600	0.0726	4,299,000
9	Ba Ria	early 2002	Gas	456	9072	37,983	54,300	0.0543	DO	12.58	10150	42,496	72,600	0.0726	2,204,495
10	VeDan	2000	FO	121	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	463,000
11	Small Diesel fired power plants	before 2000	DO	4	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	16,000
12	Can Tho FO	1999	FO	35	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	128,000
13	Can Tho DO		DO	41	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	142,000
14	Hiep Phuoc	1998	FO	373	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	1,424,000
15	Amata	1998	FO	18	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	67,000
16	Thu Duc FO	1992	FO	155	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	549,000
17	Thu Duc DO		DO	11	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	35,000
18	Pha Lai 1	1986	coal	1582	5035	21,081	94,600	0.0946	DO	4.84	10150	42,496	72,600	0.0726	2,459,000
19	Uong Bi	1975	coal	475	6020	25,205	94,600	0.0946	DO	0.66	10150	42,496	72,600	0.0726	668,875
20	Ninh Binh	1974	coal	537	5500	23,027	94,600	0.0946	DO	0.08	10150	42,496	72,600	0.0726	689,000
21	**Imports from China**														383,000

Data for calculating of $EF_{grid, OM, 2006}$

General information			FUEL 1: Main fuel						FUEL 2: Sub fuel						Emission factor
ID(j)	NAME (m)	COM (m)	FUEL (1,m)	FC (1,m,2006)	NCV (1,2006)		EF (CO2,1,2006)		FUEL (2,m)	FC (2,m,2006)	NCV (2,2006)		EF (CO2,2,2006)		EG(m,2006)
ID number of the power plant 'm'	Name of the power plant 'm' serving the grid in year '2006' except low-cost/must-run power plant	Commission date of the whole power plant	Fuel type '1' combusted in power plant 'm' in year '2006'	Amount of fossil fuel type '1' consumed by power plant 'm' in year '2006'	Net Calorific Value (energy content) of fossil fuel type '1' in year '2006'		CO2 emission factor of fossil fuel type '1' in year '2006'		Fuel type '1' combusted in power plant 'm' in year '2006'	Amount of fossil fuel type '2' consumed by power plant 'm' in year '2006'	Net Calorific Value (energy content) of fossil fuel type '2' in year '2006'		CO2 emission factor of fossil fuel type '2' in year '2006'		Net electricity generated and delivered to the grid by the power plant 'm' in year '2006'
-	-	-	-	(Coal, DO, FO: kt; Gas: million m3)	(Coal, DO, FO: kCal/kg Gas: kCal/	(Coal, DO, FO: GJ/kt, Gas:GJ/million m3	kg CO2/TJ	tCO2/GJ	-	(Coal, DO, FO: kt; Gas: million m3)	(Coal, DO, FO: kCal/kg Gas: kCal/	(Coal, DO, FO: GJ/kt Gas: GJ/million m3	kg CO2/TJ	tCO2/GJ	MWh

					m3						m3				
1	Cao Ngan	May 2006	coal	39	4500	18,841	94,600	0.0946	DO	0.06	10150	42,496	72,600	0.0726	70,000
2	Phu My Fertilizer Plant	January 2006	Gas	27	9072	37,983	54,300	0.0543	0	0.77	10150	42,496	0	0.0000	141,000
3	Phu My 2.1	December 2005	Gas	1147	9072	37,983	54,300	0.0543	DO	13.45	10150	42,496	72,600	0.0726	6,110,000
4	Na Duong	November 2005	coal	453	3950	16,538	94,600	0.0946	DO	0.62	10150	42,496	72,600	0.0726	709,000
5	Phu My 2.2	February 2005	Gas	871	9072	37,983	54,300	0.0543	DO	56.42	10150	42,496	72,600	0.0726	4,856,000
6	Phu My 4	July 2004	Gas	615	9072	37,983	54,300	0.0543	DO	3.19	10150	42,496	72,600	0.0726	3,211,000
7	Formosa	April 2004	coal	381	6500	27,214	94,600	0.0946	DO	0.96	10150	42,496	72,600	0.0726	1,086,000
8	Phu My 3	March 2004	Gas	691	9072	37,983	54,300	0.0543	DO	89.57	10150	42,496	72,600	0.0726	4,110,000
9	Phu My 1	June 1905	Gas	1196	9072	37,983	54,300	0.0543	DO	1.37	10150	42,496	72,600	0.0726	6,417,000
10	Pha Lai 2	December 2002	coal	2085	4950	20,725	94,600	0.0946	DO	3.80	10150	42,496	72,600	0.0726	4,315,000
11	Ba Ria	early 2002	Gas	434	9072	37,983	54,300	0.0543	DO	4.14	10150	42,496	72,600	0.0726	2,024,000
12	VeDan	2000	FO	135	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	514,000
13	Small Diesel fired power plants	before 2000	DO	7	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	25,000
14	Can Tho FO	1999	FO	36	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	128,000
15	Can Tho DO		DO	33	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	109,000
16	Hiep Phuoc	1998	FO	250	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	955,000
17	Amata	1998	FO	7	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	26,000
18	Thu Duc FO	1992	FO	133	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	472,000
19	Thu Duc DO		DO	11	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	32,000
20	Pha Lai 1	1986	coal	1821	5035	21,081	94,600	0.0946	DO	6.29	10150	42,496	72,600	0.0726	2,937,000
21	Uong Bi	1975	coal	547	6020	25,205	94,600	0.0946	DO	0.92	10150	42,496	72,600	0.0726	757,000
22	Ninh Binh	1974	coal	567	5500	23,027	94,600	0.0946	DO	0.09	10150	42,496	72,600	0.0726	794,000
23	**Imports from China**														966,000

Data for calculating of $EF_{grid, OM, 2007}$

General information			FUEL 1: Main fuel				FUEL 2: Sub fuel				Emission factor
ID(j)	NAME (m)	COM (m)	FUEL (1,m)	FC (1,m,2007)	NCV (1,2007)	EF (CO2,1,2007)	FUEL (2,m)	FC (2,m,2007)	NCV (2,2007)	EF (CO2,2,2007)	EG(m,2007)

ID number of the power plant 'm'	Name of the power plant 'm' serving the grid in year '2007' except low-cost/must-run power plant	Commission date of the whole power plant	Fuel type '1' combusted in power plant 'm' in year '2007'	Amount of fossil fuel type '1' consumed by power plant 'm' in year '2007'	Net Calorific Value (energy content) of fossil fuel type '1' in year '2007'		CO2 emission factor of fossil fuel type '1' in year '2007'		Fuel type '1' combusted in power plant 'm' in year '2007'	Amount of fossil fuel type '2' consumed by power plant 'm' in year '2007'	Net Calorific Value (energy content) of fossil fuel type '2' in year '2007'		CO2 emission factor of fossil fuel type '2' in year '2007'		Net electricity generated and delivered to the grid by the power plant 'm' in year '2007'
-	-	-	-	(Coal, DO, FO: kt; Gas: million m3)	(Coal, DO, FO: kCal/kg Gas: kCal/m3	(Coal, DO, FO: GJ/kt, Gas:GJ/million m3	kg CO2/TJ	tCO2/GJ	-	(Coal, DO, FO: kt; Gas: million m3)	(Coal, DO, FO: kCal/kg Gas: kCal/m3	(Coal, DO, FO: GJ/kt Gas: GJ/million m3	kg CO2/TJ	tCO2/GJ	MWh
1	Ca Mau	April 2007	Gas	132	9072	37,983	54,300	0.0543	0	3.86	10150	42,496	0	0.0000	691,000
2	Cai Lan	January 2007	DO	21	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	81,000
3	Expansion Uong Bi	October 2006	coal	244	5094	21,328	94,600	0.0946	DO	0.50	10150	42,496	72,600	0.0726	520,000
4	Cao Ngan	May 2006	coal	246	4500	18,841	94,600	0.0946	DO	0.43	10150	42,496	72,600	0.0726	445,000
5	Phu My Fertilizer Plant	January 2006	Gas	28	9072	37,983	54,300	0.0543	0	1.78	10150	42,496	0	0.0000	150,000
6	Phu My 2.1	December 2005	Gas	1111	9072	37,983	54,300	0.0543	DO	35.97	10150	42,496	72,600	0.0726	5,975,000
7	Na Duong	November 2005	coal	475	3950	16,538	94,600	0.0946	DO	0.72	10150	42,496	72,600	0.0726	744,000
8	Phu My 2.2	February 2005	Gas	885	9072	37,983	54,300	0.0543	DO	60.14	10150	42,496	72,600	0.0726	5,004,000
9	Phu My 4	July 2004	Gas	591	9072	37,983	54,300	0.0543	DO	18.06	10150	42,496	72,600	0.0726	3,210,000
10	Formosa	April 2004	coal	390	6500	27,214	94,600	0.0946	DO	1.08	10150	42,496	72,600	0.0726	1,113,000
11	Phu My 3	March 2004	Gas	656	9072	37,983	54,300	0.0543	DO	75.07	10150	42,496	72,600	0.0726	3,883,000
12	Phu My 1	June 1905	Gas	1437	9072	37,983	54,300	0.0543	DO	10.86	10150	42,496	72,600	0.0726	8,033,700
13	Pha Lai 2	December 2002	coal	2028	4950	20,725	94,600	0.0946	DO	4.06	10150	42,496	72,600	0.0726	4,198,000
14	Ba Ria	early 2002	Gas	417	9072	37,983	54,300	0.0543	DO	25.40	10150	42,496	72,600	0.0726	1,983,000
15	VeDan	2000	FO	140	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	534,000
16	Small Diesel fired	before 2000	DO	11	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	42,000

	power plants															
17	Can Tho FO	1999	FO	38	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	137,000
18	Can Tho DO		DO	45	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	151,000
19	Hiep Phuoc	1998	FO	452	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	1,726,000
20	Amata	1998	FO	3	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	13,000
21	Thu Duc FO	1992	FO	166	9910	41,491	75,500	0.0755	0	0.00	0	0	0	0.0000	603,000
22	Thu Duc DO		DO	23	10150	42,496	72,600	0.0726	0	0.00	0	0	0	0.0000	70,000
23	Pha Lai 1	1986	coal	1737	5035	21,081	94,600	0.0946	DO	6.03	10150	42,496	72,600	0.0726	2,832,000
24	Uong Bi	1975	coal	516	6020	25,205	94,600	0.0946	DO	0.76	10150	42,496	72,600	0.0726	694,000
25	Ninh Binh	1974	coal	530	5500	23,027	94,600	0.0946	DO	0.11	10150	42,496	72,600	0.0726	729,000
26	**Imports from China**														2,630,000

Data for calculating of $EF_{grid, BM, 2007}$

ID(j)	NAME (m)	COM (m)	CAPn(m,y)	Registered as CDM project activities?	GEN(m,y)
ID number of the power plant 'j'	Name of the power plant 'm'	Commission date of the whole power plant and/or started to supply electricity to the grid	Net generation capacity of the power plant 'm' in year 'y'		Net electricity generation delivered to the grid by the power plant 'm' in year 'y'
-		-	MW	Yes/No	GWh
1	Suoi Sap	December 2007	14.4	No	0.7
2	Quang Tri	November 2007	64.0	No	64
3	Ngoi Xan 1	August 2007	8.1	Yes	15
4	Nậm Tha 6	July 2007	6.0	Yes	10
5	Se San 3A	May 2007	108.0	No	345
6	Ea Krong Rou	May 2007	28.0	No	75
7	Ca Mau	April 2007	500.0	No	691
8	Cai Lan	January 2007	39.0	No	81
9	Srokphu Mieng	December 2006	51.0	No	252
10	Expansion Uong Bi	October 2006	300.0	No	520
11	Se San 3	July 2006	260.0	No	1130
12	Cao Ngan	May 2006	115.0	No	445
13	Phu My Fertilizer Plant	January 2006	18.0	No	150
14	Phu My 2.1	December 2005	966.0	No	5975
15	Na Duong	November 2005	110.0	No	744
16	Phu My 2.2	February 2005	733.0	No	5004
17	Phu My 4	July 2004	468.0	No	3210
18	Formosa	April 2004	150.0	No	1113
19	Phu My 3	March 2004	733.0	No	3883
20	Nam Mu	February 2004	12.0	No	62
21	Can Don	January 2004	77.6	No	361
22	Na Loi	May 2003	9.3	No	42
23	Phu My 1	2003	1114.0	No	8034
24	Pha Lai 2	December 2002	600.0	No	4198
25	Ba Ria	early 2002	388.8	No	1983
26	Small hydropower plants	before 2002	42.0	No	648
27	Da Mi	2001	175.0	No	630
28	Ham Thuan	2001	300.0	No	1186
29	VeDan	2000	72.0	No	534
30	Ialy	2000	720.0	No	3413
31	Song Hinh	2000	70.0	No	398
32	Nomura - Hai Phong	2000	56.0	No	0
33	Bourbon	2000	24.0	No	69
34	Small Diesel fired power plants	before 2000		No	42.0

35	Can Tho FO	1999	188.0	No	137
36	Can Tho DO			No	151
37	Hiep Phuoc	1998	375.0	No	1726
38	Amata	1998	13.0	No	13
39	Thac Mo	1995	150.0	No	899
40	Hoa Binh	1994	1920.0	No	9100
41	Vinh Son	1994	66.0	No	260
42	Thu Duc FO	1992	291.9	No	603
43	Thu Duc DO			No	70
44	Tri An	1989	400.0	No	2038
45	Pha Lai 1	1986	440.0	No	2832
46	Uong Bi	1975	105.0	No	694
47	Ninh Binh	1974	100.0	No	729
48	Thac Ba	1972	108.0	No	324
49	Da Nhim	1964	167.5	No	1187
50	**Imports from China**		550.0	No	2630

IPCC default values

Fuel fossil	CO2 emission factor [kg CO2/TJ]	Source
Diesel	72,600	*IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories*
Residual Fuel Oil	75,500	
Anthracite	94,600	
Gas	54,300	

Annex 4

MONITORING INFORMATION

An overall monitoring plan will be applied to the project. The two Sub-stations share a same monitoring and management manual: "Technical Design for Electric Metering System". The aim of monitoring plan is to make sure that the net generated electricity monitored during the project activities' operation period is completed, consistent, clear and precise. The details are summarized as follows:

A. Description of technical equipment

The main metering system will be installed at the connecting point in Kon Plong Transformer Station. They are digital meters bi-directly with the accuracy at least 0.5s.

The meter type used is an electronic 3 phase and details on the technical equipment can be found in the hard copy document "Technical explanation 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 Dak Pone Hydropower Plant (HPP). Before the power metering equipment puts into operation, PC3-Investment Joint Stock Company (Project Owner) and EVN should check and accept it. Each terminal block of these equipments are sealed with lead to prevent all the unallowable interferences.

This proposed project will supply the electricity to the national grid at the 22 kV voltage level. The metering system includes the main system and back-up system:

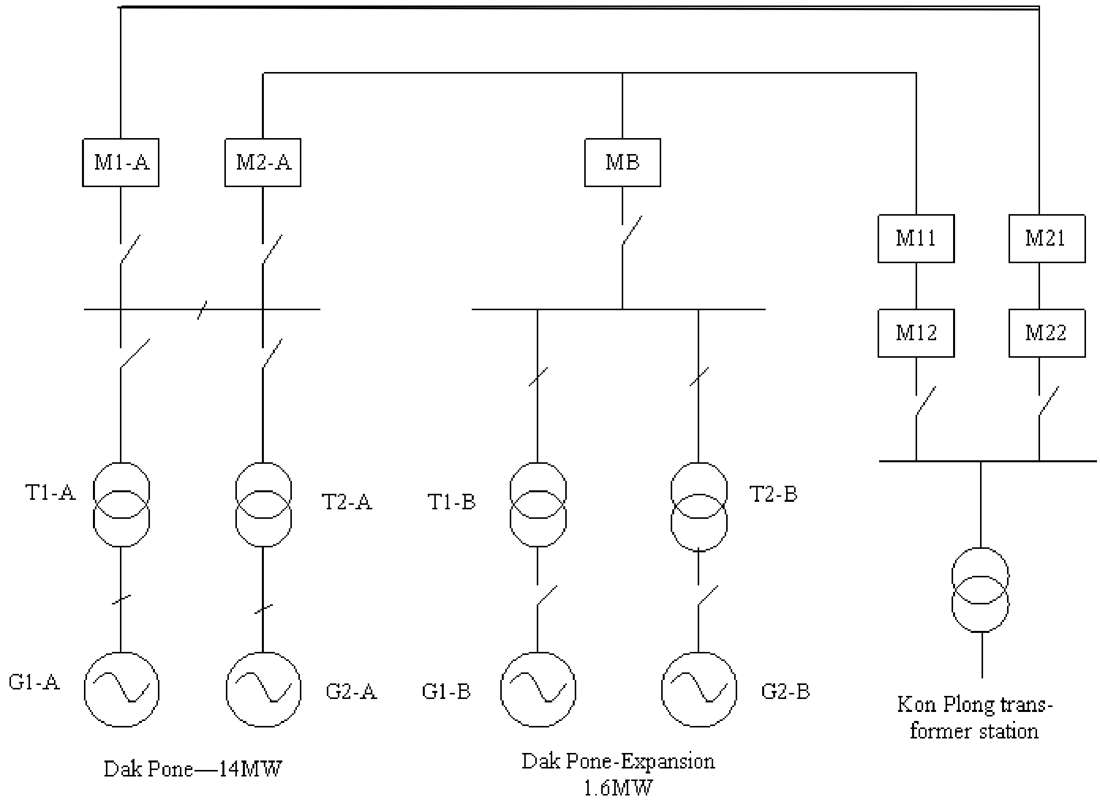
- Main system: M11 and M21 power meters located in Kon Plong Transformer Station, in which
  - M11: Measure the total electricity export and import at the first transmission line
  - M21: Measure the total electricity export and import at the second transmission line
- Backup system: M12 and M22power meters next to the main power meters, in which
  - M12: Measure the total electricity export and import at the first transmission line
  - M22: Measure the total electricity export and import at the second transmission line

In addition, there is also a metering system for measuring the Total electricity generation. It includes 2 separately power meter for Dak Pone hydropower plant and 1 power meter for Dak Pone – Expansion. The total electricity generation can be calculated by summing up the values of these meters for each hydropower plant.

As the meter type used is an electronic meter, so data from the meters is transferred frequently to an electronic database on a personal computer (PC).

In case there is no electricity provided to the power plant, the power plant, the diesel generator will generate electricity for internal use of the plant. This emission from the diesel generator will measured and determined as in Project emissions of section B.6 and monitored as in section B.7

According to the Basic Technical Design of the Dak Pone project, the installation of equipment of powerhouse and meters is illustrated as below.



M11, M21, M12, M22: Digital meters
M1-A, M2-A, MB: Display on LCD of control system
G1-A, G2-A, G1-B, G2-B: Generator No 1, No2, No3 and No4, respectively
T1A, T2-A, T1-B, T2-B: Transformer No1, No2, No3 and No4, respectively

Figure 4: Monitoring system

B. Monitoring organization

The structure of the monitoring group is as follows:

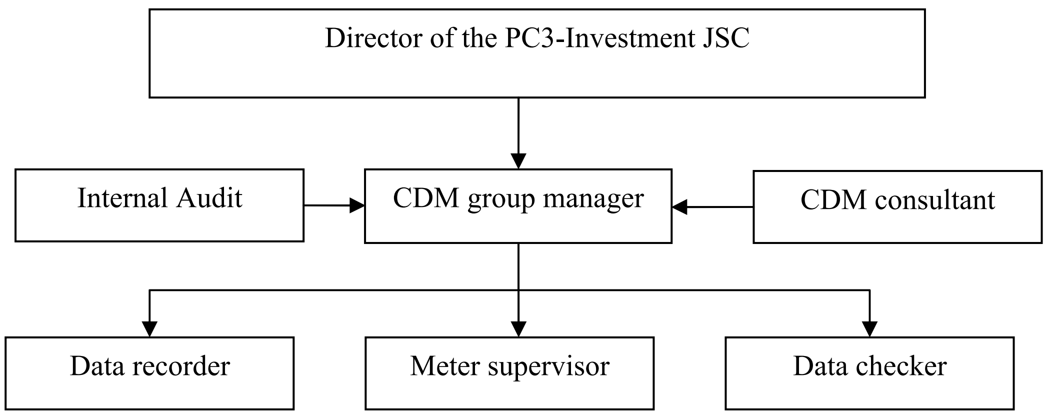


Figure 5: Structure of the monitoring group

The responsibilities of each person involved are elaborated as follows:

Group members and their responsibilities[60]

Person	Responsibility
Director of the PC3-Investment JSC or authorised by the Director	Check and sign the monitoring report annually
CDM group manager	Managing the whole CDM business, guiding and supervising data recorder after trained by CDM consultant.
CDM consultant (VNEEC)	Providing CDM group manager training and technical support about CDM monitoring plan.
Internal auditor	Check the monitoring procedure at least once in a year
Data recorder	Collecting and recording data every month.
Meter supervisor	Checking power meter periodically according to relevant regulation.
Data checker	Double checking the collected data measured by power meter.

C. Monitoring procedures

The steps of monitoring the electricity supplied to the grid and the electricity imported from grid and consumed by the proposed project are as follows:

(1) The electricity supplied by the project to the grid will be automatically monitored by the two meter systems (main and backup). The data is measured continuously

(2) Persons in charge of data record and meter supervisor from Dak Pone power plant together with staff from EVN shall read and collect data from main power meters and backup power meters every month, the result or the joint balance sheet will be signed by both parties and kept respectively;

(3) The electricity sales invoice shall be sent to EVN, and the copy of each invoice shall be kept

[60] Group members will be adjusted based on the actual adjustment of PC3-Investment JSC

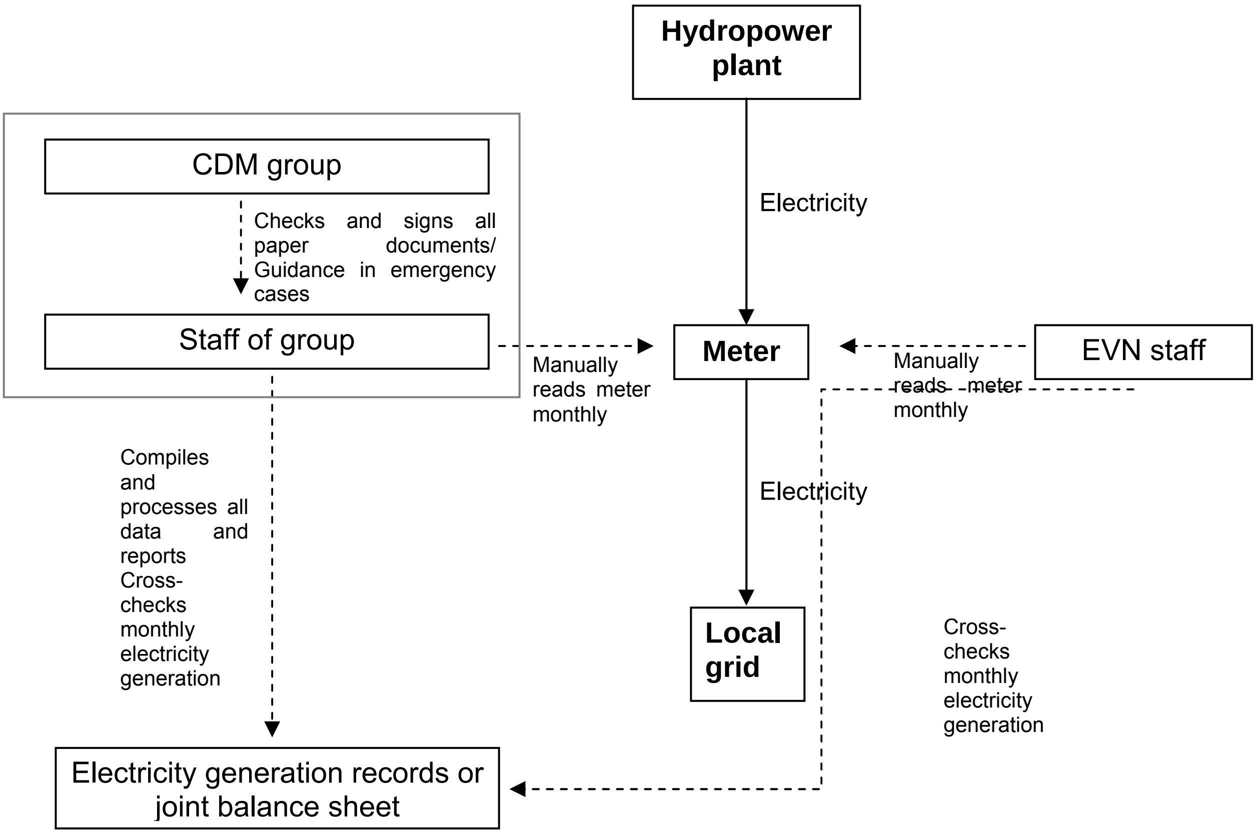


Figure 6: Monitoring process

D. Calibration of metering equipment

Before on-site installation meters will be calibrated and verified by local STAMEQ or other third party pursuant to the Decision No 65/2002/QD-BKHCNMT[61]. According to this Decision, calibration and verification for 3 phase meters need to be conducted every two years. This means that calibration will be undertaken by the third party once in every two-year period during project operation. The third party will after every calibration seal the meters so that no interference is possible.

E. Data recording and archiving procedures

- The CDM group appointed by The Project Owner shall keep monitored data in electronic archives every month. Paper documents should be stored in electronic format and copied by CD. Electronic documents should be printed out and kept.
- The Project Owner shall keep the copy of electricity sales/purchase invoices (the original electricity sales/purchase invoices shall be kept by Finance Department of PC3-Investment JSC).

[61] Decision No 65/2002/QD-BKHCNMT[61] issued by the Minister of Scientific, Technology and Environment on 19 August 2002 to promulgate "The list of meter equipment must be calibrated and verified and the verification procedures".

- In order to help verifiers obtain documents and information related to the emission reduction of the proposed project, The Project Owner shall prepare an index of the data documents and monitoring report.
- All the data and information in the form of paper documents shall be archived by the CDM group, with at least one copy backup for each datum.
- All the data shall be kept for 2 years after the crediting period

F. Emergency procedures

In case of any unforeseen event that is not covered under this monitoring plan, staff of the CDM group shall inform the manager and the director. The manager and director are then responsible to ensure that the cause for the unforeseen event is detected, the event is remedied and for the period of time in which the unforeseen event has occurred uncertainty in data gathered is limited as much as possible.

In the case the error of main meter exceeds allowed level, the backup meter will be used to measure output of electricity exporting to grid.

In case of both main and back-up metering systems are in failure, the project owner and the power company (EVN) will jointly calculate a conservative estimate of power supplied to the grid. The assumptions used to estimate net electricity supply to the grid will be signed by both a representative of the project owner as well as a representative of the power company (EVN).

G. Training

VNEEC has been collaborated with the director of the power plant to develop a training manual and training course for the staff of CDM Group that will clearly lay out rules and procedures for all activities related to metering, data recording and processing, data archiving and preparation of monitoring reports.