PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Nam Ngiep 3A Hydropower Project
Version number of the PDD	02.0
Completion date of the PDD	28/01/2014
Project participant(s)	Phongsubthavy Road & Bridge Construction Co., Ltd.
Host Party(ies)	Lao PDR
Sectoral scope and selected methodology(ies)	Sectoral Scope 1: Energy Industries. Baseline methodology: ACM0002 Consolidated baseline methodology for grid-connected electricity generation from renewable sources
Estimated amount of annual average GHG emission reductions	85,604 t CO_2e

SECTION A. Description of project activity
A.1. Purpose and general description of project activity
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The Nam Ngiep 3A Hydro project is located in the Xieng Khouang Province, Lao PDR, about 64km to Phonesavan, the capital of Xieng Khouang Province, and 474 km to Vientiane. Developed by Phongsubthavy Road & Bridge Construction Co., Ltd. (the "project entity").

The construction of the project includes dam, diversion system, power house and transmission system. The installed capacity of the project is 44MW, with annual power supply 153 GWh.

Following the Lao PDR's electrification policy, the electricity supply falls in short compared to the increased electricity demand. The project is expected to constantly contribute clean energy to the Lao Power Grid. For the Lao Power Grid is connected with the power grid in Thailand, the power supplied by the project will not only meet domestic electricity demand, but also increase the net power export to Thailand and decrease the net power import from Thailand, where the power grid is dominated by thermal power plants. The baseline scenario of the project is continuation of the present situation, i.e. electricity supplied from the power grid. By displacing part of the power generated by thermal power plants, the project is therefore expected to reduction of CO_2 emissions by an estimated 85,604 tCO2e per year during the first crediting period.

As a renewable energy project, the project will produce positive environmental and economic benefits and contribute to the local sustainable development in following aspects:

- During the construction period, plenty of job opportunities were provided to local residents, and the newcomers surged in the area will bring local people lots of employment opportunities thus bring more revenue for the local residents;
- The infrastructures were greatly improved. The implementation of water supply program, transportation and electricity system enhancement will bring substantial benefits to local villagers;
- Reduce the local use of firewood displacing by electricity, reduce the damage to the local vegetation;
- Power supplied to the regional grid consisting of Thailand Power Grid and the Lao Power Grid, will provide clean & cheap electricity power in this region, promote the sustainable development in this region and slowing down the increasing trend of GHG emissions

A.2. Location of project activity
A.2.1. Host Party(ies)
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The project is located in Lao PDR and is connected to the regional grid which extends across Lao PDR and Thailand. Therefore both of the two countries are listed as host Parties.

A.2.2. Region/State/Province etc.
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Xieng Khouang Province

A.2.3. City/Town/Community etc.
>>
Phonsavan City

A.2.4. Physical/Geographical location

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The dam of the project is located on the Nam Ngiep River, about 64km to Phonesavan, the capital of Xieng Khouang Province, and 474 km to Vientiane. The approximate coordinates of the project site is: 19°17'23''N, 103°20'30''E.

Figure A.1 Show the location of the project:

Figure A.1. Location of the project

A.3. Technologies and/or measures

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After completion of the project, the newly built plant will provide clean electric power to the regional grid consisting of Thailand Power Grid and the Lao Power Grid. The scenario prior to the start of implementation of the project activity is provision of the equivalent amount of electricity generated by the power plants connected with the regional grid, which is dominated by thermal power plants, thus leads to mass of GHG emissions. The baseline scenario is the same as the scenario prior to the start of implementation of the project activity.

The Nam Ngiep 3A Hydropower Project is a hydropower project with total install capacity 44 MW. The construction of the project includes main dam, spillway, intake, headrace channel, penstock, power house, switch yard and tailrace channel.

The project includes 3 units of 13 MW vertical shaft Francis turbine and generator sets and 2 units of 2.5 MW horizontal and generator sets. Total installed capacity is44MW.

Table A.1. Main Technical Parameters of propose project

Turbine		
Type	HLA575C-LJ-130	HLA179a-WJ-95
Quantity	3	2
Rated capacity	13.542 MW	2.612 MW
Rated head	151.3 m	151.3 m
Rated flow	9.81 m^3/s	2.0 m^3/s
Rated Rotation speed	600 r/min	750r/min
Manufacturer	Dongfang Electric Corporation International	

Generator		
Type	SF13-10/2860	SWF2500-8/1730
Quantity	3	2
Rated capacity	13 MW	2.5 MW
Rated voltage	11 kV	6.3 kV
Frequency	50Hz	50 Hz
Rated speed	600 r/min	750 r/min
Manufacturer	Dongfang Electric Corporation International	

The power generated by the five generators will be supplied to Nahor substation through 115kV transmission lines respectively and then distributed in Lao Power Grid.

The construction of the project activity will lead to a new reservoir with a power density greater than 10 W/m^2, the project emissions is due to the CH_4 released from the reservoir is zero.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Lao PDR (host)	Phongsubthavy Road & Bridge Construction Co., Ltd. (Project owner)	**No**

The project is located in Lao PDR and is connected to the regional grid which extends across Lao PDR and Thailand. Therefore both of the two countries are listed as host Parties.

A.5. Public funding of project activity

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The project does not receive any public funding from Parties included in Annex I of the UNFCCC. The project does not use ODA directly or indirectly.

SECTION B. Application of selected approved baseline and monitoring methodology
B.1. Reference of methodology
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Approved consolidated baseline and monitoring methodology ACM0002 (Version 13.0, EB 67): Consolidated baseline methodology for grid-connected electricity generation from renewable sources.

This methodology draws upon the following tools:
Tool for the demonstration and assessment of additionality (Version 7.0.0, EB 70), and
Tool to calculate the emission factor for an electricity system (Version 3.0.0, EB 70)

Please click following link for more information about the methodology and tool:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2. Applicability of methodology
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The baseline and monitoring methodology ACM0002 is applicable to the proposed project, because the project meets the applicability criteria stated in the methodology:

i.   *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 is to install a new hydro power plant and hence comply with the above applicability criterion.

ii.   *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 $EG_{facility,y}$): 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 criterion is not relevant to a new hydro power plant like this project.

iii.   *In case of hydro power plants, one of the following conditions must apply:*
- *The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or*
- *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; or*
- *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m².*

The project result in a new reservoir and the power density of 24.44[1] W/ m² is greater than the requirement of 4 W/m². The project matches with the above applicability criterion.

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[1] The power density is calculated by dividing the submersed area by the installed capacity. The installed capacity of the project is 44 MW; the area of reservoir at full water level is 1,800,000 m2. Therefore, the power density =44,000,000/1,800,000=24.44 W/m2.

The methodology is not applicable to the following:

iv.   Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;

v.   Biomass fired power plants;

vi.   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/m².

The project does not relevant to the criteria iv to vi, so it is eligible to be developed under ACM0002 (Version 13.0).

"Tool to calculate the emission factor for an electricity system" (Version 3.0.0) was adopted to estimate the emission factor of the project. According to the "Tool to calculate the emission factor for an electricity system":

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).

The power generated by the project will be supplied to the regional grid consisting of Thailand Power Grid and the Lao Power Grid, and result in saving of electricity that would have been provided by the grid. Therefore, the "Tool to calculate the emission factor for an electricity system" is applicable for this project.

B.3. Project boundary

Spatial boundary

The power generated by the project will be supplied to the Lao Power Grid, which connected with Thailand Power Grid through transmission lines. According to the "Calculation for the emission factor for electricity generation in Lao PDR, 2010" published by the Lao DNA, the regional grid consisting of Thailand Power Grid and the Lao Power Grid is adopted as the project boundary.

According to ACM0002 (Version 13.0), the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

According to "Tool to calculate the emission factor for an electricity system", the project electricity system is defined as the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (i.e. the renewable power plant location) and that can be dispatched without significant transmission constraints. A connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

According to the tool mentioned above, there are no transmission constraints if any one of the following criteria is met:

i.   *In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of less than five per cent between the two electricity systems during 60 per cent or more of the hours of the year; or*

ii. *The transmission line is operated at 90 per cent or less of its rated capacity at least during 90 per cent of the hours of the year.*

As demonstrated by the official document by Lao DNA mentioned above, for transmission lines between Thailand and Lao Power Grid, there is no spot market exists, so the criteria i. list above is not applicable. Furthermore the load of the transmission lines between Lao Power Grid and Thailand Power Grid is far below 50% of its rated capacity during all the year[2]. So, the electricity system does not have significant transmission constrain.

According to the "Tool to calculate the emission factor for an electricity system":

In addition, in cases involving international interconnection (i.e. transmission line is between different countries and the project electricity system covers national grids of interconnected countries) it should be further verified that there are no legal restrictions for international electricity exchange.

The grid between Lao and Thailand kept enormous power exchange, and the power comparison of Laos export, import and domestic demand are listed below:

Table B.1 Power exchange between Lao and Thailand (Unit: GWh)

	2010	2009	2008
Lao power export to Thailand[3]	6,938.45	2,385.84	2,315.43
Domestic demand in Lao[4]	2,228.15	1,901.29	1,577.86
Lao power import from Thailand (EDL)[5]	1,042.12	1,081.19	772.8

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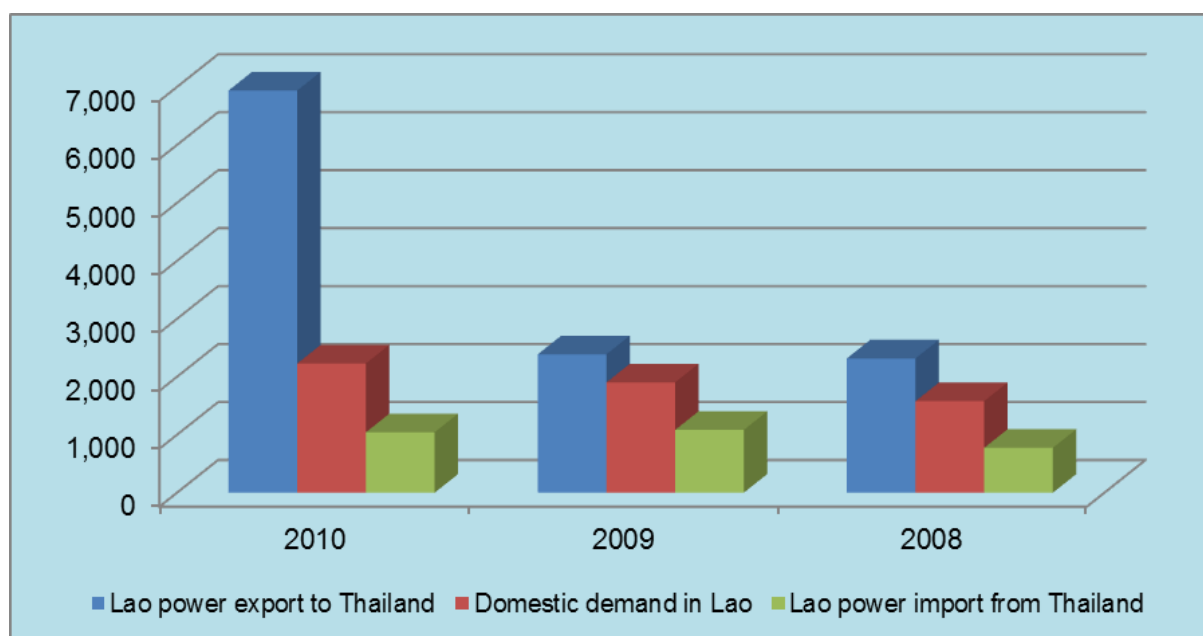
[2] Information provided by EDL, regarding to the power load of the transmission lines between Laos and Thailand.
[3] EGAT Annual Report 2010, page 101 & Annual Report 2009, page 88, Electricity Generating Authority of Thailand.
[4] EDL Annual Report 2009, page 17, Electricite du Laos.
[5] EGAT Annual Report 2010, page 102 & Annual Report 2009, page 89, Electricity Generating Authority of Thailand.

Figure B.1 Power exchange between Lao and Thailand (Unit GWh)

The data listed above indicates the close relationship between the power system of Lao and Thailand. The Thai and Lao power system have kept intimately cooperation, and Thailand government promised that 7,000 MW power will be imported from Lao PDR during 2010 to 2015[6]. According to the MOU signed between Lao government and Thailand government, through the interconnection between the two countries, Lao power grid could sold the surplus energy to Thailand, and the deficits of Lao demand in rush hours can be covered by imports. Based on the above information, it could be concluded that there are no legal restrictions for international electricity exchange.

Based on the reasons listed above, it is shown that the most appropriate definition of the spatial extension of the project electricity system is a regional grid consisting of Thailand Power Grid and the Lao Power Grid.

Emission sources and gases

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

Table B.2. GHG emissions in Project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non condensable gases contained in geothermal steam.	CO_2	No	Not applicable to hydro power Project
		CH_4	No	
		N_2O	No	
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants.	CO_2	No	Not applicable to hydro power Project
		CH_4	No	
		N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source
		CH_4	Yes	Minor emission source
		N_2O	No	Minor emission source

A flow diagram of the project boundary is presented in Figure B.2 below. The flow diagram physically delineates the project boundary, includes the flow of electricity and the project electricity system (the regional grid consisting of Thailand Power Grid and the Lao Power Grid), and the GHG emissions.
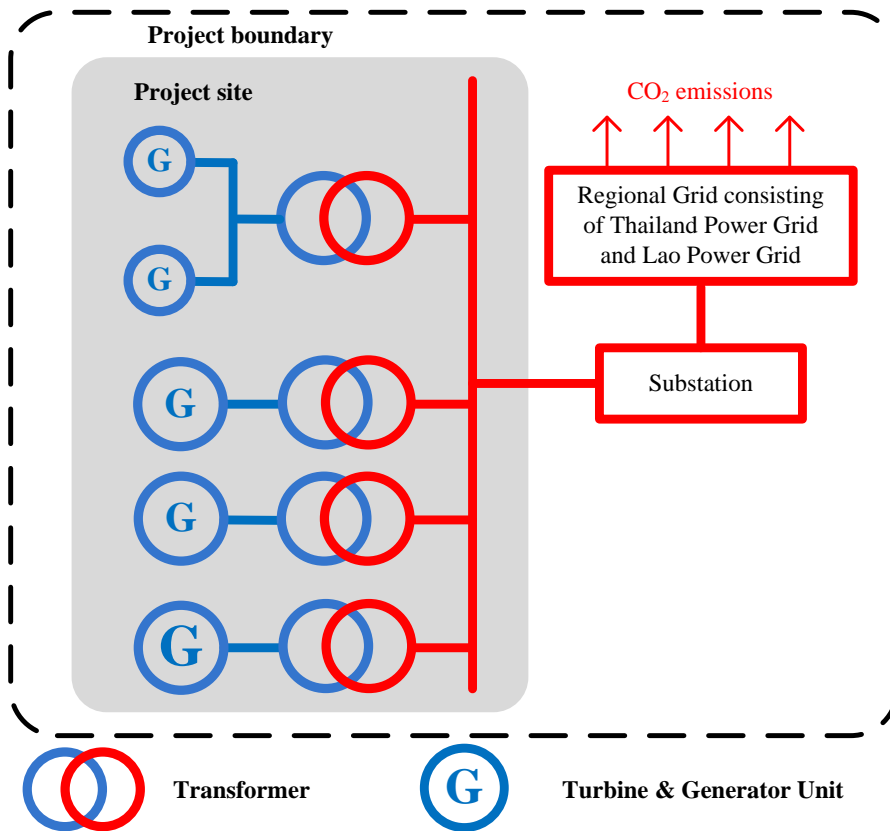
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[6] http://uk.reuters.com/article/idUKBKK15938520071018

Figure B.2. Flow diagram of the project boundary

B.4. Establishment and description of baseline scenario
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According to ACM0002 (Version 13.0), 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 (CM) calculations described in the Tool to calculate the emission factor for an electricity system.*"

The project activity is the installation of a new grid-connected renewable power plant/unit, and is not a modification/retrofit of an existing plant/unit, therefore, the baseline scenario is provision of the equivalent amount of electricity generated by the power plants connected with the regional grid consisting of Thailand Power Grid and the Lao Power Grid, and the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (Version 3.0.0).

B.5. Demonstration of additionality
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Prior consideration of CDM

To overcome financial weakness, and unfavourable conditions that the project encounters, the project owner decided to seek CDM assistance after the project Feasibility Study Report has been completed by independent design institute in July 2011.

In 14/11/2011, the Equipment purchase Contract was signed, it was considered as the starting date of the project.

In the 15/11/2011, the prior consideration form was submitted to both the DNA and UNFCCC.

According to the definition of the "starting date of a CDM project activity" provided in paragraph 67 of EB41 meeting report, the starting date of the Project is determined as 14/11/2011. The prior consideration form was submitted within 6 months after the project start, the CDM was seriously considered in the decision to implement the project activity.

Additionality

According to the "Tool for the demonstration and assessment of additionality" (Version 7.0.0) approved by EB, the additionality of the project is demonstrated and assessed through 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:

Plausible and credible alternatives available to the project that provide outputs or services comparable to the proposed CDM project activity include:

Alternative a): The project activity not undertaken as a CDM project activity;
Alternative b): Construction of a thermal power plant with equivalent installed capacity or annual electricity generation;
Alternative c): Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation;
Alternative d): Provision of an equivalent amount of annual power output by the grid into which the project is connected.

Alternative a) is in compliance with all applicable legal and regulatory requirements. But according to the investment analysis in step 2, this scenario is less attractive with low IRR and is not realistic without CDM financing.

Alternative b) is not a realistic alternative. According to the Power System Development Plan for Lao PDR, there isn't an existing thermal power plant with the similar or larger power generation capacity with Nam Ngiep 3A project in Lao yet, furthermore, at the proposed project site, there isn't any coal mine developed, the only way to obtain enough material is transport coal from other regions, and thus will significantly increase the cost in such a mountainous region.

Alternative c), other kinds of renewable energy technologies, such as wind, solar PV, geothermal, and biomass are possible grid-connected sources. However, according to the *Country Paper Rural Energy Development and Utilization* [7], these projects face varies barriers in awareness, finance, law and institution and technologies, etc. The other kinds of renewable energy technologies in Lao are not mature

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[7] Prepared by Renewable Energy Technology Center, Technology Research Institute of Lao PDR,

currently and lack of financial attractive to construct power plants with the similar power generation capacity with Nam Ngiep 3A project.

Alternative d) is in compliance with all applicable legal and regulatory requirements.

Outcome of Sub-step 1a: demonstrates that the identified realistic and credible alternative scenarios to the project activity are Alternatives a), d).

Sub-step 1b. Consistency with mandatory laws and regulations:

All the alternatives identified above are in compliance with applicable rules and regulations in Lao PDR.

Outcome of Step 1b: demonstrates that the identified realistic and credible alternative scenarios to the project activity are Alternatives a), d).

Step 2. Investment analysis

The purpose of this step is to determine whether the project activity is economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs). The investment analysis was conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

The *"Tool for the Demonstration and Assessment of Additionality (Version 7.0.0)"* proposal three analysis methods which are:

(Option I)   Simple cost analysis;
(Option II) Investment comparison analysis;
(Option III) Benchmark analysis;

Since the project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The Alternative d) of the project is supply electricity by the regional grid rather than newly invested projects. Therefore Option II is not appropriate. The project will use benchmark analysis method (Option III) based on the consideration that benchmark IRR of the power sector is available.

Sub-step 2b. Option III. Apply benchmark Analysis

According to the *"Tool for the Demonstration and Assessment of Additionality (Version 7.0.0)"*, there are five options for discount rates and benchmarks determine:

a)   *Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;*
b)   *Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;*
c)   *A company internal benchmark (weighted average capital cost of the company), only in the particular case where the project activity can be implemented by the project participant, the specific financial/economic situation of the company undertaking the project activity can be*

considered. The project developers shall demonstrate that this benchmark has been consistently used in the past i.e. that project activities under similar conditions developed by the same company used the same benchmark;

d)   *Government/official approved benchmark where such benchmarks are used for investment decisions;*

e)   *Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified.*

For this project, option a) was applied. The project adopted US dollar as the currency accounted and invested in Lao PDR, thus the benchmark is combined by the maturity rate of the 3-month US Treasury bill and the risk premium on lending of Laos which could respectively reflect the risk-free return of the currency adopted and the risk premium of the host country.

The average value of the 3-Month US Treasury Constant Maturity Rate[8] at the recent 20 years before the starting date (Nov 14th 1991 ~ Nov 14th 2011) 3.25% will be introduced to represents the risk free rate (nominal rate, consistent with the calculation of cash flow) for the following reasons:

i.   There is no systematic government bond issue structure in Lao PDR;
ii.   The project was accounted in U.S. dollar, and the 3-month U.S. Treasury rate is a widely accepted risk-free rate[9];
iii.   The average value in the recent 20 years before the starting date was applied since the long term average value reduces the short term uncertainty and violation of the market..

Regarding the value of national risk premium. The data "Risk premium on lending (prime rate minus Treasury bill rate; %)" provided by World Bank[10] was applied. Risk premium on lending is the interest rate charged by banks on loans to prime private sector customers minus the "risk free" Treasury bill interest rate at which short-term government securities are issued or traded in the market. The data is proper to illustrate the "suitable risk premium to reflect private investment" in the host country stated in the *"Tool for the Demonstration and Assessment of Additionality (Version 7.0.0)"*. To reduce the short term uncertainty, the average risk premium of Lao PDR in the latest 5 years 12.68% was adopted (the risk premium of Lao PDR from 2006 to 2010 are 11.70, 10.10, 11.70, 15.30 and 14.60 respectively).

So, the benchmark adopted equals the maturity rate of the 3-month US Treasury bill plus the Risk premium on lending in Lao PDR, the value is 15.93% (post-tax).

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

1)   Basic parameters for calculation of financial indicators

Based on the Feasibility Study Report (FSR) accomplished by the third party, the main assumptions for the investment analysis are shown in Table below.

Table B.5. Basic parameters of the project

Basic parameters	Unit	Value	Source
Installed capacity	MW	44	FSR
Annual net power supplied	GWh	153	FSR
Fixed assets investment	Million USD	53.9	FSR

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[8] Website of the Federal Reserve Bank of St. Louis http://research.stlouisfed.org/fred2/series/DGS3MO?cid=47
[9] http://www.investopedia.com/terms/r/risk-freerate.asp#axzz1V9mGhc6k
[10] http://data.worldbank.org/indicator/FR.INR.RISK

Electricity Tariff	USD/kWh	0.06	FSR
Project lifetime	year	25	FSR
Construction period	year	3	FSR

The analysis shows that without the revenue of CERs, the IRR of the project will be 10.79%. Much lower than the benchmark 15.93%. The project is not financial attractive. However, the CDM revenues will help project overcome the investment barriers.

Sub-step 2d. Sensitivity analysis

The sensitivity analysis shows whether the conclusion regarding financial attractiveness is robust to reasonable variations in the critical assumptions. For the project, the most important parameters impacting the project IRR are:

- Fixed assets investment
- Annual O&M cost
- Electricity tariff (including VAT)
- Power supplied to the grid

In case of the ±10% variation range of the four parameters, the fluctuations of the IRR (without CER revenue) are showing below:

Table B.6. Sensitive analysis of the project

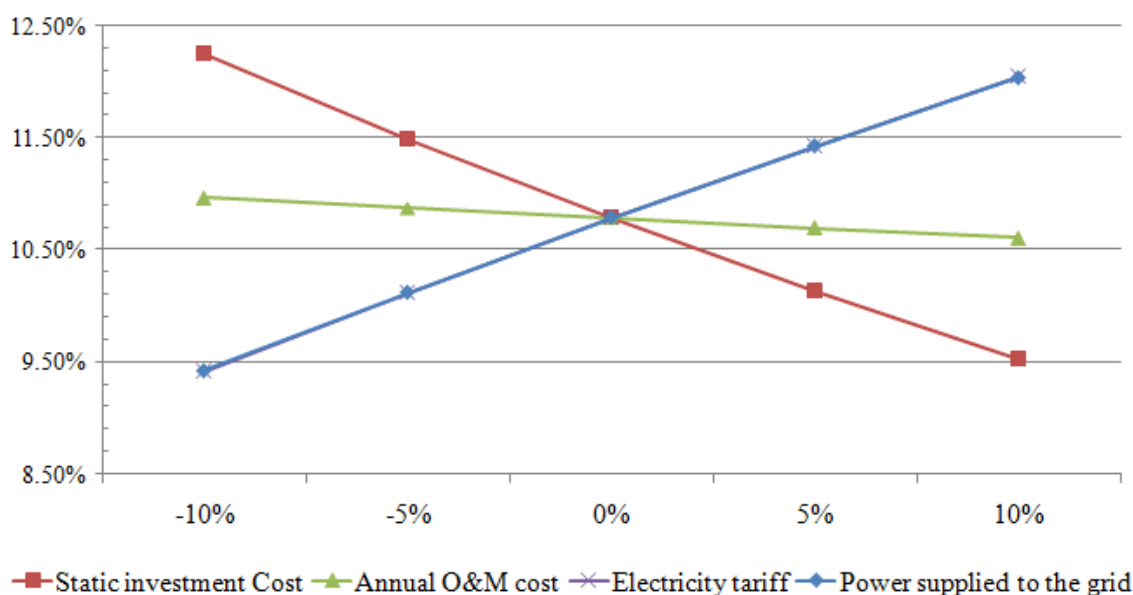| Variation range / IRR / Parameters	-10%	-5%	0%	+5%	+10%
Fixed assets investment	12.25%	11.49%	10.79%	10.14%	9.53%
Annual O&M cost	10.97%	10.88%	10.79%	10.70%	10.61%
Electricity tariff	9.42%	10.12%	10.79%	11.43%	12.05%
Power supplied to the grid	9.43%	10.12%	10.79%	11.43%	12.04%

Figure B.3. Sensitive analysis

Based on the relationship shown above, we can find out that the project IRR that will decline accompany with the rise of the fixed assets investment and the annual O&M cost; and the IRR will rise accompany with the rise of the electricity tariff and the electricity supply. We can conclude from the above analysis that, even if ±10% variation range of the four parameters, the IRR of the project still can't surpass the benchmark. However, the revenue from the CERs will greatly improve the financial feasibility of the project.

Based on the above analysis, the project IRR could reach the benchmark 15.93% if one of the following conditions can be achieved:

Table B.8. Conditions make the IRR reach the benchmark

Parameters	Overall
Fixed assets investment	-29.2%
Annual O&M cost	-318.0%
Electricity tariff	44.0%
Power supplied to the grid	44.1%

However, none of these conditions can be achieved due to the following reasons:

1) Regarding the fixed assets investment

The parameters adopted from the FSR that finalized by the third party with abundant experiences in hydropower projects. The fixed assets investment estimated in the FSR is in line with local standards on engineering, construction and equipments. In fact, through comparing with the actual signed contracts, about 84.2% of the static investment estimated in FSR has already accomplished, thus it is unlikely to decrease the investment as much as 29.2%.

2) Regarding the annual O&M cost

O&M is not a sensitive parameter. In this project, even if the O&M decreased to zero, the IRR is still lower than the benchmark.

3) Regarding the electricity tariff

The Tariff adopted in the analysis is sourced from the FSR that finalized by the third party. The value is the same with the Power Purchase Agreement signed between the Project Owner and the power grid company, thus it is reasonable to apply in the IRR calculation and it is unlikely to increase it by such a high percentage.

4) Regarding the power supplied

The power supply is determined by the FSR author according to a relative long-term local hydrological data. There may exist fluctuations and uncertainty among the practical situation in each operational year regarding to the precipitation and runoff of the river, but the space of fluctuation would be limited, it is unlikely to deviate from the long-term hydrological data as much as 44.1% annually.

In conclusion, without the consideration of the revenue from CERs, the conclusion of the project activities lacks of commercial attraction is evidenced, so the specific project is in shortage of commercial attraction.

Step 3 Barrier analyses

This step is not adopted.

Step 4 Common practice analyses

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

As per *Tool for the Demonstration and Assessment of Additionality*, projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory frame-work, investment climate, access to technology, access to financing, etc. According to the *Guidelines On Common Practice (version 01)*, common practice analysis is presented through the following 4 steps.

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The installed capacity of Nam Ngiep 3A Hydropower Project is 44MW, the projects with capacity ±50% of the project (22~66 MW) are considered as similar size.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project.

The regulatory policies, investment environment and hydrology conditions are different by countries, therefore, Lao PDR where the project located is selected as the applicable area for common practice. Projects located in Lao PDR with installed capacity of 22~66MW, which started commercial operation before the starting date of the project are selected for further analysis. According to EDL Annual Report 2010 and Electric Power Plants in Laos[11], there are 3 projects were observed.

Table B.9. Similar hydropower projects comparison

Project name	Capacity MW	Commissioning year	Ownership	CDM application
Nam Leuk	60	2000	EDL	No
Nam Mang 3	40	2004	EDL	No
Se Xet 1	45	1990	EDL	No

Refer to the projects listed above, the parameter N_{all} is 3.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

As mentioned in the Table B.9, all the projects is operated by the national power grid utility EDL, the ownership are strikingly different from the Nam Ngiep 3A Project, which is a IPP project developed by private investor. As an private project investor, it confronts quite different investment environment while the state owned projects have more favorable conditions. Furthermore, for a state owned project, the purposes of the project development are multiple, not only for profits-seeking, but also for other targets like national electrification, flood protection and upgrade infrastructure etc. Thus only IPP projects were defined as the comparable projects.

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[11] EDL Electric Power Plants in Laos Published in Jul, 2011.

In conclusion, the projects listed in the Table B.9 applied different technology compare with Nam Ngiep 3A Hydropower Project according to the criteria provided by the *Guidelines On Common Practice*, the parameter N_{diff} is 3.

Step 4: Calculate factor F=1- N_{diff}/N_{all} representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

Based on the above analysis, the parameter F representing the share of plants using technology similar to the technology used in the project activity in all plants that deliver the same output or capacity as the project activity, which is calculated by 1-N_{diff}/N_{all}=0. Since F is less than 0.2, it can be concluded that the project is not a common practice and the project is additional.

In conclusion, all the steps above are satisfied, the proposed CDM project is not the baseline scenario, and the proposed project activity is additional.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
>>
The Methodology ACM0002 (version 13.0) is applied in the context of the project in the following four steps:

- **Step 1, calculate the project emissions;**
- **Step 2, calculate the baseline emissions;**
- **Step 3, calculate the project leakage;**
- **Step 4, calculate the emission reductions.**

Calculate the project emissions

According to Methodology, the project emissions shall be calculated by the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ (Equation B.1)

Where:
PE_y =   Project emissions in year y (tCO$_2$e/yr)

$PE_{FF,y}$ =   Project emissions from fossil fuel consumption in year y (tCO$_2$/yr)

$PE_{GP,y}$ =   Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO$_2$e/yr)

$PE_{HP,y}$ =   Project emissions from water reservoirs of hydro power plants in year y (tCO$_2$e/yr)

For this project, does not involve the fossil fuel consumption and geothermal power, so $PE_{FF,y}$=0, $PE_{GP,y}$=0. For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for project emissions, estimated as follows:

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

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000}$$ (Equation B.2)

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs (tCO_2e/yr)

EF_{Res} = 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)

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

$$PE_{HP,y}=0 \qquad\qquad \text{(Equation B.3)}$$

The PD of the project activity is calculated as follows:

$$PD=\frac{Cap_{PJ}-Cap_{BL}}{A_{PJ}-A_{BL}} \qquad\qquad \text{(Equation B.4)}$$

Where:

PD = Power density of the project activity (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

Calculate the baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y=EG_{PJ,y} \times EF_{grid,CM,y} \qquad\qquad \text{(Equation B.5)}$$

Where:

BE_y = Baseline Emissions in year y (tCO_2/yr)

$EG_{PJ,y}$ = Quantity of net electricity supplied to 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

According to Methodology, if 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:

$$EG_{PJ,y}=EG_{facility,y} \qquad\qquad \text{(Equation B.6)}$$

The emission coefficient (measured in tCO2e/MWh) should be calculated in a transparent and

conservative manner according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system" (Version 3.0.0).

The data used for calculation are from an official source (where available) and publicly available. The calculation processes are as follows:

STEP 1: Identify the relevant electricity system.
STEP 2: Choose whether to include off-grid power plants in the project electricity system.
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: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emissions factor.

STEP 1: Identify the relevant electricity system

The DNA of Lao has published a delineation[12] of the project electricity system and connected electricity systems, therefore these delineations are applied. The Project will supply power to Lao Power Grid, which according to the delineation published by Lao DNA, is a part of the regional power grid consisted by Lao and Thailand power grid. Therefore, the relevant electricity system is the regional power grid including Lao Power Grid and Thailand Power Grid. And the **connected electricity system** is Malaysia, China and Vietnam Power Grid[13].

For the purpose of determining the operating margin emission factor, 0 tCO$_2$/MWh was applied as the emission factor(s) for net electricity imports from a connected electricity system.

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

According to "Tool to calculate the emission factor for an electricity system" (Version 3.0.0), there are two options to calculate the operating margin and build margin emission factor:

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.

Option I is chosen for operating margin and build margin emission factor calculation.

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

According to "Tool to calculate the emission factor for an electricity system" (Version 3.0.0), there are four methods for calculating the $EF_{grid,OM,y}$:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM

---

[12] See Calculation for the emission factor for electricity generation in Lao PDR, 2010
[13] According to Electrical Power in Thailand 2008, 2009, 2010, Thailand DEDE, the Thailand import power from Lao PDR and Malaysia. Lao is considered as part of the project electricity system, and Malaysia is considered as the connected electricity system. Vietnam and China are also considered as connected electricity system for the power supply to Lao according to the Annual Repot 2012 by the Lao Power Grid Electric du Lao (EDL).

The method (d), average OM, is selected.

EF$_{grid,OM-ave,y}$ is calculated using ex ante option: a 3-year generation-weighted average in 2010, 2009, 2008, without requirement to monitor and recalculate the emissions factor during the crediting period.

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

The average OM emission factor is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under Step 4 in the "Tool to calculate the emission factor for an electricity system" for the simple OM, but also including the low-cost / must-run power plants in all equations.

According to "Tool to calculate the emission factor for an electricity system" (Version 3.0.0), there are two options based on different data for calculating average OM:

Option A: Based 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.

For the project, the necessary data for Option A is not available, so Option B was used.

Under this option, the average OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OM-ave,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_y}$$ (Equation B.7)

Where:

$EF_{grid,OM-ave,y}$ =   Average operating margin CO2 emission factor in year y (tCO2/MWh)

$FC_{i,y}$ =   Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)

$NCV_{i,y}$ =   Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

$EF_{CO2,i,y}$ =   CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)

EG_y =   Net electricity generated and delivered to the grid by all power sources serving the system in year y (MWh)

i =   All fossil fuel types combusted in power sources in project electricity system in year y

y =   The data available in the most recent 3 years

According to the "Tool to calculate the emission factor for an electricity system" (Version 3.0.0), electricity imports from the connected electricity systems $EG_{import,y}$ are included in the EG_y.

The detailed calculating procedures please refer to Appendix 4 of the PDD.

Step 5. Calculate the build margin (BM) emission factor

To calculate the build margin (BM) emission factor, the data for determine the sample group of power units m about the most recently units in the electricity system is needed. However, as an international project system, it's difficult to obtain the information for all the units in both Lao and Thailand (power generation data, commissioning date, and the fuel consumption). The data requirements for the application for calculate the build margin (BM) emission factor cannot be met.

As the Simplified CM is adopted in the step 6, the weighting of build margin emissions factor is 0.

STEP 6: Calculate the combined margin (CM) emissions factor

According to "Tool to calculate the emission factor for an electricity system" (Version 3.0.0), the calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a)   Weighted average CM; or
(b)   Simplified CM.

According to Tool to calculate the emission factor for an electricity system, the simplified CM can be used if:
(a)   The project activity is located in: (i) a Least Developed Country (LDC); or in (ii) a country with less than 10 registered CDM projects at the starting date of validation; or (iii) a Small Island Developing States (SIDS); and
(b)   The data requirements for the application of Step 5 above cannot be met.

Lao is a Least Developed Country, therefore the criteria (a) is met; As mentioned in step 5, the data requirements for the application for calculate the build margin (BM) emission factor is not available, therefore the criteria (b) is also met.

The Simplified CM method is calculated as follow:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y}$$ (Equation B.8)

Where:
w_{OM} =   Weighting of operating margin emission factor (%);
w_{BM} =   Weighting of build margin emission factor (%).

The weighs w_{OM} and w_{BM}, for simplified CM by default, are $w_{OM}=1$ and $w_{BM}= 0$.

Calculate the project leakage

No leakage emissions are considered.

Calculate the emission reductions

Emission reductions are calculated as follows:
$$ER_y = BE_y - PE_y$$ (Equation B.9)

Where:
ER_y =   Emission reduction in year y (t CO_2e/yr)
BE_y =   Baseline emission in year y (t CO_2e/yr)
PE_y =   Project emission in year y (t CO_2e/yr)

B.6.2. Data and parameters fixed ex ante

Data / Parameter:	$FC_{i, y,}$
Data unit:	mass or volume unit of the fuel i
Description:	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
Source of data used:	*Calculation for the emission factor for electricity generation in Lao PDR, 2010*
Value applied:	See Appendix 4 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Lao DNA.
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	kJ/kg or kJ/m^3
Description:	The net calorific value (energy content) per mass or volume unit of fuel *i* in year *y*.
Source of data used:	*Electric Power in Thailand 2010*
Value applied:	See Appendix 4 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Thailand authorities, DEDE.
Any comment:	

Data / Parameter:	$EF_{CO2, i,y,}$
Data unit:	tCO2/TJ
Description:	The CO2 emission factor per unit of fuel *i* in year *y*,
Source of data used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Chapter 1 Table 1.4*
Value applied:	See Appendix 4 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	No specific local value available, the value form IPCC 2006, Guidelines for National Greenhouse Gas Inventories was adopted.
Any comment:	

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the system, including low-cost/must-run power plants/units, in year *y*.
Source of data used:	*Calculation for the emission factor for electricity generation in Lao PDR, 2010*

Value applied:	See Appendix 4 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Lao DNA.
Any comment:	-

Data / Parameter:	$EG_{import,y}$
Data unit:	MWh
Description:	The electricity(MWh) imported from Malaysia, Vietnam and China Power Grid in year y.
Source of data used:	*Electricity report by EGAT (2010, 2009, 2008)* *EDL Annual Report 2012*
Value applied:	See Appendix 4 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Thailand authorities, EGAT and Lao authorities, EDL.
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m²
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full
Source of data used:	Methodology ACM0002(Version 12.1) default value,
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	For new reservoirs, this value is zero.
Any comment:	-

Data / Parameter:	CAP_{BL}
Data unit:	MW
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data used:	*Methodology ACM0002 (Version 12.1)*
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	For new hydro power plants, this value is zero
Any comment:	-

B.6.3. Ex ante calculation of emission reductions
>>
Project emission

PE_y=0 tCO$_2$e

Baseline emission

According to section B.6.1, in first crediting period, the baseline emission factor of the project:

$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y}$ =0.5595 tCO$_2$e/MWh.

The baseline emission of the project:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} = EG_{facility,y} \times EF_{grid,CM,y}$ = 153,000 ×0.5595=85,604 tCO$_2$e

Project leakage

No leakage emissions are considered.

Emission reductions

$ER_y = BE_y - PE_y$ =85,604 – 0 = 85,604 tCO2e

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO$_2$e)	Project emissions (t CO$_2$e)	Leakage (t CO$_2$e)	Emission reductions (t CO$_2$e)
Year 1	85,604	0	0	85,604
Year 2	85,604	0	0	85,604
Year 3	85,604	0	0	85,604
Year 4	85,604	0	0	85,604
Year 5	85,604	0	0	85,604
Year 6	85,604	0	0	85,604
Year 7	85,604	0	0	85,604
Total	599,228	0	0	599,228
Total number of crediting years	7			
Annual average over the crediting period	85,604	0	0	85,604

B.7. Monitoring plan
B.7.1. Data and parameters to be monitored

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh

Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data to be used:	Calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$EG_{facility,y} = EG_{output,y} - EG_{input,y}$
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	Please refer to $EG_{output,y}$ and $EG_{input,y}$
Any comment:	-

Data / Parameter:	$EG_{output,y}$
Data unit:	MWh
Description:	Electricity supplied by the project to the grid in year y
Source of data to be used:	Measured by meters.
Value of data	153,000 MWh
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording
QA/QC procedures to be applied:	According to the recommendation by the manufacturer or the regulations of the grid company, meters will be calibrated periodically. Data measured by meters will be cross-checked with the record document confirmed by EDL.
Any comment:	-

Data / Parameter:	$EG_{input,y}$
Data unit:	MWh
Description:	The electricity used by the project and input from the grid in year y
Source of data to be used:	Measured by meters.
Value of data	Estimated to be 0 MWh for ex-ante calculation
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording
QA/QC procedures to be applied:	According to the recommendation by the manufacturer or the regulations by the grid company, meters will be calibrated periodically. Data measured by meters will be cross-checked with the record document confirmed by EDL.
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity

Source of data to be used:	Project site
Value of data	44
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	M^2
Description:	Area of the single or multiple reservoirs 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	1,800,000
Description of measurement methods and procedures to be applied:	Annually measured from topographical surveys, maps, satellite pictures, etc
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2. Sampling plan
>>
The data and parameters monitored in section B.7.1 above are not determined by a sampling approach.

B.7.3. Other elements of monitoring plan
>>
The purpose of the monitoring plan is to ensure that the monitoring and calculation of emission reductions of the project within the crediting period is complete, consistent, clear and accurate. The plan will be implemented by the project owner with the support of the grid corporation.

1. Monitoring organization

The monitoring process will be carried out and responsibility by the project owner. A monitoring panel will be established by the plant managers to be in charge of monitoring the data and information relating to the calculation of emission reductions with the cooperation of the Technical and Financial Department. A CDM manager will be assigned full charge the monitoring works. The operation and management structure is shown below:
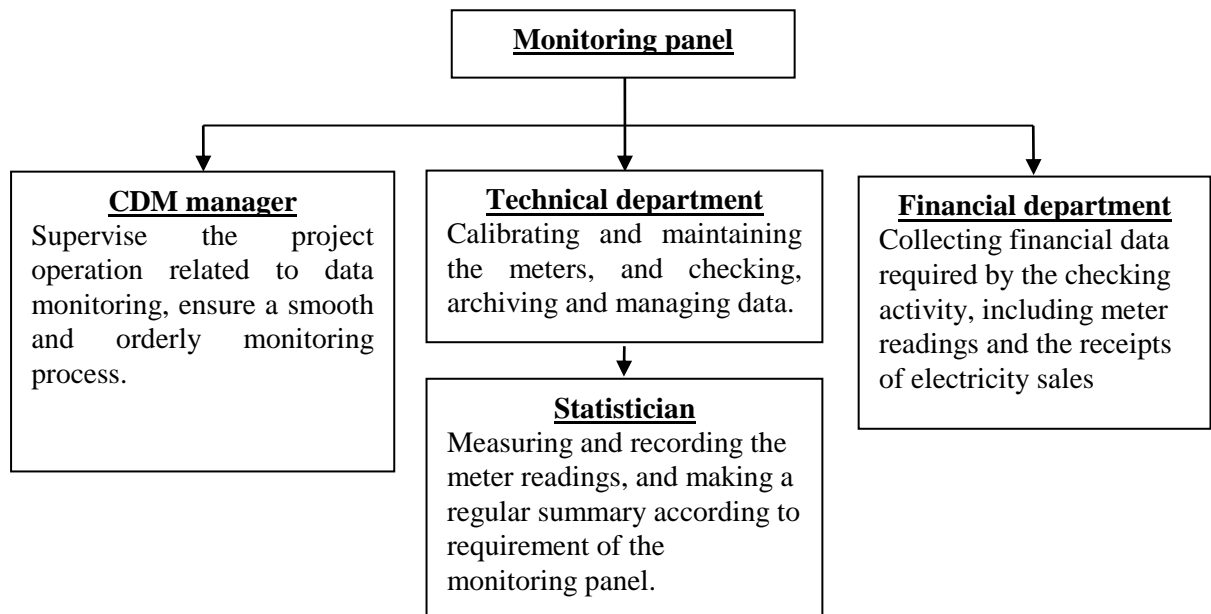
```
┌─────────────────────────────┐
│      Monitoring panel       │
└─────────────────────────────┘
```

CDM manager	**Technical department**	**Financial department**
Supervise the project operation related to data monitoring, ensure a smooth and orderly monitoring process.	Calibrating and maintaining the meters, and checking, archiving and managing data.	Collecting financial data required by the checking activity, including meter readings and the receipts of electricity sales

Statistician
Measuring and recording the meter readings, and making a regular summary according to requirement of the monitoring panel.

Figure B.4. Organization structure of the monitoring activity

2. Monitoring apparatus and installation:

The meters will be installed in accordance with relevant national or international standard. Before the operation of the project, the metering equipments will be clarified and examined by the project owner and the power grid company according to the above regulation.

3. Data collection:

The specific steps for data collection and reporting are listed below:

a) During the crediting period, both the grid company and the project owner will record the values displayed by the main meter.

b) Simultaneously to step a), the project owner will both record the values displayed by the backup meters.

c) The meters will be calibrated according to the relevant regulation and request of EDL.

d) The main meter's readings will be cross-checked with record document confirmed by EDL.

e) The project owner and the grid company will record both output and input power readings from the main meter. These data will be used to calculate the amount of net electricity delivered to the grid.

f) The project owner will be responsible of providing copies of record document confirmed by EDL to the DOE for verification.

If the reading of the main meter in a certain month is inaccurate and beyond the allowable error or the meter doesn't work normally, the grid-connected power generation shall be determined by following measures:

g) Read the data of the backup meters.

h) If the backup meter's data is not so accurate as to be accepted, or the practice is not standardized, the project owner and the grid corporation should jointly make a reasonable and conservative estimation method which can be supported by sufficient evidence and proved to be reasonable and conservative

when verified by DOE.

i)   If the project owner and the grid corporation don't agree on an estimated method, arbitration will be conducted according the procedures set by the agreement to work out an estimation method.

4.   Calibration

Calibration of Meters should be implemented according to relevant standards and rules accepted by the grid company EDL. After the examination, the meters should be sealed. The lift of the seals requires the presence of both the project owner and the grid company. One party must not lift the seals or fiddle with the meters without the presence of the other party.

All the meters installed shall be tested by a qualified metering verification institution commissioned jointly by the project owner and the grid company within 10 days after:

1)   Detection of a difference larger than the allowable error in the readings of both meters;
2)   The repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications.

5.   Data management system

Physical document such as the plant electrical wiring diagram will be gathered with this monitoring plan in a single place. In order to facilitate auditors' access to project documents, the project materials and monitoring results will be indexed. All paper-based information will be stored by the technical department of the project owner and all the material will have a copy for backup. All data, including calibration records, will be kept until 2 years after the end of the total crediting period.

6.   Monitoring Report

During the crediting period, at the end of each year, the monitoring officer shall produce a monitoring report covering the past monitoring period. The report shall be transmitted to the General Manager who will check the data and issue a final monitoring report in the name of the projects participants. Once the final report is issued, it will be submitted to the DOE for verification.

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity
>>
14/11/2011 (Equipment purchase agreement signed)

C.1.2. Expected operational lifetime of project activity
>>
25 years

C.2. Crediting period of project activity
C.2.1. Type of crediting period
>>
First period of renewable crediting period

C.2.2. Start date of crediting period
>>
01/01/2014 or the date of registration whichever is later.

C.2.3. Length of crediting period
>>
7 years of the first crediting period

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
>>
The Environmental Impact Assessment for Nam Ngiep 3A Hydropower project was compiled by qualified institute. According to this report, environmental impacts caused by the project and the corresponding measures adopted by the project owner for mitigation are as following:

Water Quality

Waste water mainly includes domestic wastewater and soil sediment in water. The domestic wastewater generated during the construction and operation period will be treated in the septic tank, and the sludge will be utilized as fertilizer for farming and forestry instead of being discharged directly into the water system. Excess in soil sediment load in water may occur at the early stage of construction for excavation works. The construction will occur during the dry season that the river flow is low and slow, we may expect that sediment will deposit rapidly and consequently reducing the impacts.

Atmospheric /air impact Assessment

The possible impact on the air quality include: dust and smoke from trucks and heavy equipment engines. The impacts will be temporary and of limited significance if consider the Project is located in a non populated area, several km from the nearest village. Water spraying will be the primary protection measure against dust. Smoke emission from engines can also be controlled by appropriate maintenance of engines.

Noise

Noise will be generated during the construction activity, due to transportation and excavation work. Measures to reduce noise impact will consist in adopting low noise construction equipments and reasonable arrange construction process. Any equipment which generates a high level of noise will be forbidden from operating at night. Moreover, the project owner will try as much as possible to keep workers far from noise sources.

Solid waste

The solid waste includes discarded soil and stone generated during the construction as well as residential garbage. Discarded soil and stone will be collected at special areas and then transported to a waste disposal site. Some discarded stone will be used for local residential housing constructions. Garbage bins present in the construction living area will be used to collect the residential garbage generated during the construction and operation periods. The residential garbage will be regularly sent to a garbage disposal station for landfill.

In conclusion, environmental impacts arising from the Project are considered insignificant.

D.2. Environmental impact assessment
>>
Both the Host Party and the project participant regard that the proposed project will not bring significant negative impact to the environment. The project could be put into commencement only after the approval of the Environmental Impact Assessment with Environmental Management Plan by local Environmental Protection Administration.

SECTION E. Local stakeholder consultation
E.1. Solicitation of comments from local stakeholders
>>
The Stakeholders Forum was held in a form of series of Public Consultation workshop and information discloses. The participants of the consultation were from different groups including: Representative of government officials at the district, representative of Lao Women's Union at village level, Lao national front for Construction Youth Union at the village level, and head of village and head of household.

The stakeholders took part in the workshops, and stated their concerns on the issues on land use, water supply, infrastructure construction, and local cultures. The workshops discussed such topics and put forward corresponding mitigation measures.

To ensure that locals were consulted in an open and transparent way, a survey was conducted via questionnaire distributed and collected by the project owner. 50 questionnaires were distributed and 50 questionnaires were returned.

The profile of the participants of survey is as follows:

Table E.1. Basic information of the survey participants

Item	Category	Number	Percentage
Age	Below 30	14	28%
	30~40	16	32%
	40~50	13	26%
	Above 50	7	14%
Gender	Male	28	56%
	Female	22	44%
Education	Elementary school	21	42%
	Junior high school	17	34%
	Senior high school	10	20%
	College and above	2	4%

The contents and results of this questionnaire survey were as follows:

1) Do you agree with the construction of the project;

2) What is the influence on local economic development for the project implement;

3) What is the influence on local residents' livelihood for the project implement;

4) Will the project improve the local employment;

5) What are the influences on the local environment you concern about;

6) In general, what's your opinion on the project environment effects.

E.2. Summary of comments received
>>
The summary of the questionnaires are as follows:

1) 92% of the respondents agree with the construction of the project, 8% of them don't care with the project, and 0% of the respondents disagree with the construction of the project.

2) There are 76% of the respondents consider the implement of the project have positive influence on local economic development, and 24% of the respondents consider the implement of the project have no influence on local economic development, and 0% of the respondents consider the implement of the project have negative influence on local economic development.

3) There are 58% of the respondents consider the implement of the project can improve the live quality of local residents, 42% of the respondents consider the implement of the project have no influence on local residents' livelihood, and 0% of the respondents consider the implement of the project will reduce local residents' livelihood.

4) There are 88% of the respondents consider the implement of the project could improve local employment, 0% of the respondents consider the implement of the project will reduce local employment opportunities, 12% of the respondents consider the implement of the project have no influence on local employment.

5) When asked about the impacts on the local environment, 12% of the respondents worry about the dust produced during the project construction, 30% of the respondents worry about the effect of noise, 24% of the respondents worry about the soil and water conservation problem, 26% of the respondents worry about the effect of solid wastes, and 8% of the respondents worry about the effect to the ecological environment;

6) 16% of the respondents consider the construction of the project will improve local environment condition, 30% of the respondents consider the construction of the project have no influence to local environment, 54% of the respondents consider the construction of the project may bring some problems, but the problems can be mitigated or controlled after environmental protection measures adopted, 0% of the respondents consider the construction of the project will reduce local environment condition.

E.3. Report on consideration of comments received

>>

From the questionnaires, it can be known that all stakeholders are in favor of the project activity. Local residents deem that the project activity will bring impact on environment, but in a slight way. Points on the impacts the stakeholders concern (dust, noise, soil and water conservation, solid wastes and ecological environment), the project owner will adopt relevant measures listed in Section D.1. No additional account is required to be taken of the comments received.

SECTION F. Approval and authorization
>>
The Letter of approval from the Parties are not obtained yet.

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Appendix 1: Contact information of project participants

Organization name	Phongsubthavy Road & Bridge Construction Co., Ltd.
Street/P.O. Box	Phongsavath Phengsikeo Village, Chanthabouli District
Building	
City	Vientiane Capital
State/Region	
Postcode	
Country	Lao PDR
Telephone	856-20-5534 5678
Fax	856-21-561 555
E-mail	
Website	
Contact person	Phongsavath PHENGSYKEO
Title	Managing Director
Salutation	Mr.
Last name	PHENGSYKEO
Middle name	
First name	Phongsavath
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding

No public funding from parties included in UNFCCC Annex I is available to the project activity.

Appendix 3: Applicability of selected methodology

Please refer to the Section B.1 of the PDD

Appendix 4: Further background information on ex ante calculation of emission reductions

Calculation of Operating Margin Emission Factor

Table 1 Net electricity generated and delivered to the grid by all power sources serving the system (GWh)

Year	2010	2009	2008
Power generation by EDL owned power plants	1,552.73	1,655.91	1,777.57
Power generation by IPP located in Laos	7,329.69	2,135.32	1,938.01
Power generation in Thailand	152,913.56	142,697.75	142,330.52
Sum up	161,795.98	146,488.98	146,046.10

Sources from:
EDL Annual Report 2012, 2010, 2009, Electricite du Laos;
Electric Power in Thailand 2010, 2009, 2008, Department of Alternative Energy Development and Efficiency, Ministry of Energy, Thailand;
Electricity Statistic Annual Report 2010, Electricity Generating Authority of Thailand.

Table 2 Power import from the connected system (GWh)

Year	2010	2009	2008
Malaysia	160.31	92.68	470.67
Vietnam	31.81	25.39	22.59
China	77.02	21.58	17.78
Sum up	269.14	139.65	511.04

Sources from:
Electricity Statistic Annual Report 2010, 2009, 2008, Electricity Generating Authority of Thailand.
EDL Annual Report 2012, Electricite du Laos.

Table 3   Quantity of GHG emission by all power sources serving the system

Fuel Type	Fuel Consumption		Fuel Specific EF	Net Calorific Value	GHG emission
	$FC_{i,y}$		$EF_{CO2,m,i,y}$	$NCV_{i,y}$	$FC_{i,y} \times EF_{CO2,m,i,y} \times NCV_{i,y}/1000000$
	Unit	FC/Unit	tCO_2/TJ	MJ/Unit	tCO_2
2010					
Natural Gas	scf.	1,073,084,673,019	54.3	1.02	59,433,868
Lignite	ton	16,043,174	90.9	10470	15,268,658
Bituminous	ton	5,502,160	89.5	26370	12,985,730
Bunker	liter	233,229,746	75.5	39.77	700,304
Diesel	liter	24,026,558	72.6	36.42	63,528
2009					
Natural Gas	scf.	968,924,717,809	54.3	1.02	53,664,864
Lignite	ton	15,818,265	90.9	10470	15,054,607
Bituminous	ton	5,486,248	89.5	26370	12,948,176
Bunker	liter	158,017,445	75.5	39.77	474,469
Diesel	liter	13,825,937	72.6	36.42	36,557

2008					
Natural Gas	scf.	977,016,893,281	54.3	1.02	54,113,058
Lignite	ton	16,407,465	90.9	10470	15,615,362
Bituminous	ton	5,578,567	89.5	26370	13,166,060
Bunker	liter	350,209,394	75.5	39.77	1,051,551
Diesel	liter	51,941,958	72.6	36.42	137,339

Sources from:
Electricity Statistic Annual Report 2010, Electricity Generating Authority of Thailand.
IPCC 2006, Guidelines for National Greenhouse Gas Inventories, Volume 2 Chapter 1 Table 1.4.
Electric Power in Thailand 2010, Energy Content of Fuel, Department of Alternative Energy
Development and Efficiency, Ministry of Energy, Thailand.

Based on the equation and above data, the $EF_{grid,OM\text{-}ave,y}$ =0.5595 tCO$_2$/MWh

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y}$$
$$= 1 \times 0.5595$$
$$= 0.5595 \text{ tCO}_2\text{e/MWh.}$$

Appendix 5: Further background information on monitoring plan

Please refer to the Section B.7 of the PDD.

Appendix 6: Summary of post registration changes

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
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