Project design document form for small-scale CDM project activities

(Version 08.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for small-scale CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Nam Hinboun Downstream Hydropower Project
Version number of the PDD	1.0
Completion date of the PDD	5/1/2018
Project participant(s)	Rasita Power Co., Ltd
Host Party	Lao PDR
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	AMS I.D. Grid connected renewable electricity generation (Version18. EB81)
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral Scope 1: Energy Industries
Estimated amount of annual average GHG emission reductions	44,235 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Nam Hinboun Downstream Hydropower Project (hereafter referred to as the "the project") is located in Songhong village, Hinboun District, Khammouane province, Lao PDR. About 40 kilometres southeast of the project is Thakhek, about 210 kilometres northwest is Vientiane, the capital of Laos. The primary purpose of the project is to generate electricity to the Lao Power Grid.

Total installed capacity of the project is 15MW, provided by two (2) bulb turbine and the unit capacity is 7.5MW. Average annual output of the project is 79,740 MWh and effective electricity supply to grid is 79,000MWh.

Following the Lao PDR's electrification policy, construction of the power station is an urgent need for regional economic development. The project is expected to constantly contribute clean energy to the Lao Power Grid. It not only conforms to the present situation, but also can adapt to future changes in the electricity market. 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 44,200 tCO_2e per year during the first crediting period.

The project is not only supply renewable electricity to grid, but also produce positive environmental and economic benefits and promotes the local sustainable development in the following aspects:

- During the construction period, plenty of job opportunities were provided to local residents, and the workers newly coming to the area are bringing local people lots of employment opportunities that increase the income of the local residents;
- The infrastructure has been greatly improved. The enhancement of the transportation and electricity system brings substantial benefits to local villagers;
- The use of firewood will be reduced because of displacement by electricity, this reduces the damage to the local vegetation;
- Provide clean & cheap electricity 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

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Lao PDR

A.2.2. Region/State/Province etc.

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Khammouane Province

A.2.3. City/Town/Community etc.

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Hinboun District

A.2.4. Physical/Geographical location

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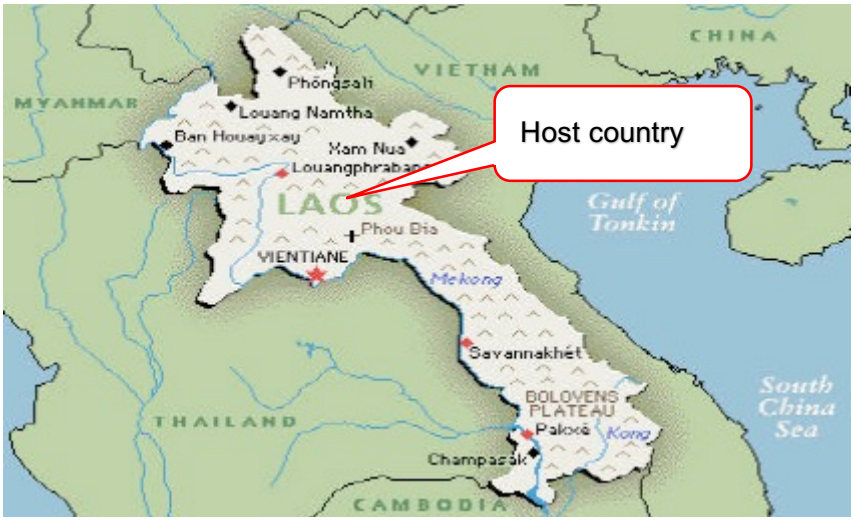
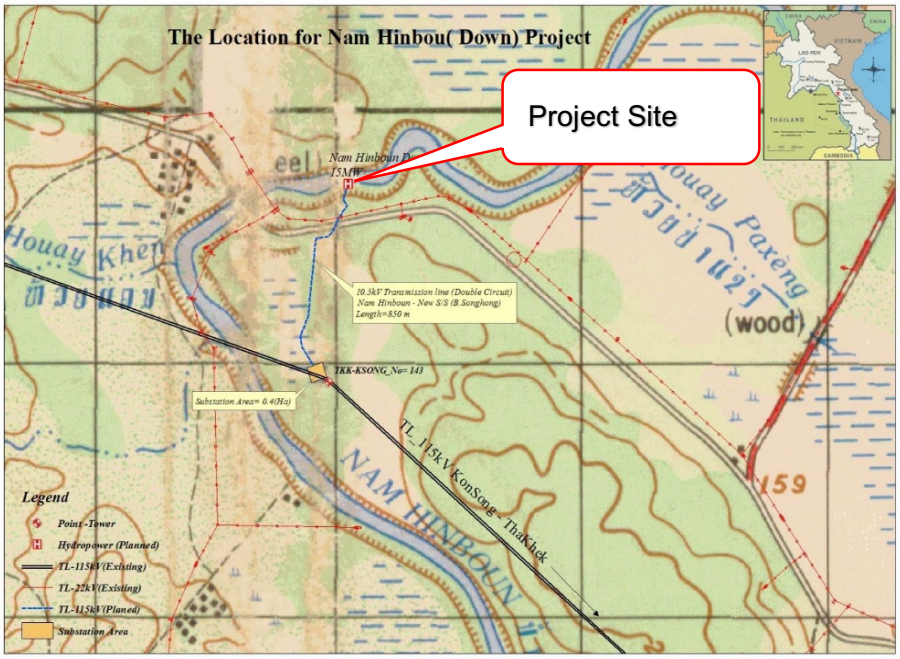
The project is located in Songhong and Samakhixai Villages, Hinboun District, Khammouane, Lao PDR.

Geographic coordinates of the project are northern latitude 17°43′38″, eastern longitude 104°34′19″.





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 the Lao Power Grid. The hydro project structure consists of release sluice, main powerhouse, and right-bank non overflow dam, etc. 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 project is run-of-river power station. The total installed capacity of the project is 15MW and two bulb turbine generator units. Refer to the following table for the main equipment's parameters.

Table A.3-1 Main Technical Parameters of the project

Turbine		
Item	Unit	Value
Number of units	set	2
Rated Capacity	MW	7.8
Normal Pool level	m	144
Rated Head	m	5
Generator		
Item	Unit	Value
Number of Units	set	2
Rated Capacity	MW	7.5
Generator Rated Power Factor	-	0.85

A.4. Parties and project participants

Party involved (host) indicates 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)	Rasita Power Co.,Ltd.	No
Switzerland	Swiss Carbon Assets Limited	No

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.

A.6. Debundling for project activity

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According to the "Assessment of Debundling for SSC Project Activities" (Version 04.0, EB 83, Annex 13), a proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small project participants;

(a) With the same project participants;
(b) In the same project category and technology/measure;
(c) Registered within the previous 2 years; and
(d)Whose project boundary is within 1km of the project boundary of the proposed small-scale activity at the closest point.

The project owner indicates that there is not a registered small-scale CDM project activity or an application to register another small-scale CDM project activity in accordance with any condition mentioned above, therefore the project is not a de-bundled component of a large project activity.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Baseline methodology:
AMS I.D. Grid connected renewable electricity generation (Version18. EB81)

This methodology draws up the following tools:
Tool for the demonstration and assessment of additionality (Version 07.0.0, EB70)
Tool to calculate the emission factor for an electricity system (Version 05.0, EB87)

And the Approval consolidated baseline and monitoring methodology ACM0002(Version 17.0, EB89): Consolidated baseline methodology for grid-connected electricity generation from renewable sources is also a reference according to AMS I.D.
Please click following link for more information about the methodology and tool:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2. Project activity eligibility

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The project is a grid connected renewable electricity generation project which meets all the applicability criteria stated in methodology AMS I.D. (version 18):

- The project makes use of renewable water resources to generate electricity to the regional grid consisting of the Lao Power Grid ;
- The project will install new power plant at the site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant);
- The total installed capacity of the project is 15 MW, it satisfies the requirement that the capacity of the project should be at most 15 MW for a small-scale CDM project;
- The other criteria stated in the AMS I.D. are not applicable to the project.

Therefore, the methodology AMS I.D.: Grid Connected Renewable Electricity Generation is applicable to the 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 transmissions lines. According to the AMS I.D., 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” is defined as the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location) and that can be dispatched without significant transmission constraints.

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

(a) In the 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

(b) 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.

For transmission lines between Thailand and Lao Power Grid, there is no spot market exists, so the criteria (a). 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[1]. So, the electricity system don not have significant transmission constrain.

According to the Para 18 of 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[2]	6938.45	2385.84	2315.43
Domestic demand in Lao[3]	2228.15	1901.29	1577.86
Lao power import from Thailand(EDL)[4]	1042.12	1081.19	772.8

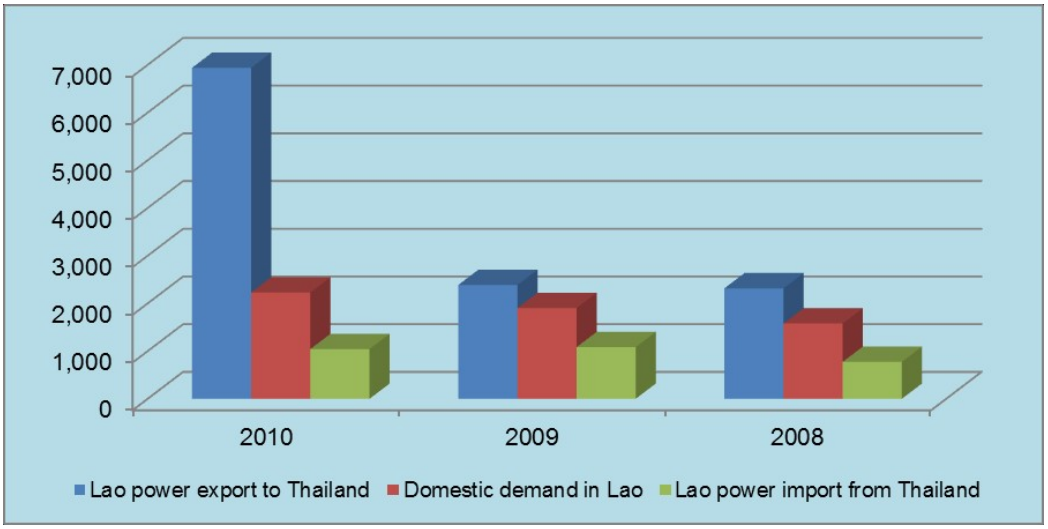

Figure B.1 Power exchange between Lao and Thailand (Unit: GWh)

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 capacity will be bought from Lao PDR during 2010 to 2015[5].

[1] Information provided by EDL, regarding to the power load of the transmission lines between Laos and Thailand.

[2] EGAT Annual Report 2010, page 101&Annual Report 2009, page 88, Electricity Generating Authority of Thailand.

[3] EDL Annual Report 2009, page 17, Electricity du Laos.

[4] EGAT Annual Report 2010, page 102 & Annual Report 2009, page 89, Electricity Generating Authority of Thailand.

[5] http://uk.reuters.com/article/idUKBKK15938520071018

According to the MOU signed between Lao government and Thailand government, through the interconnection between the two countries, Lao power grid could sell 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 exclude from the project boundary are shown in the table below: Table B3-1. A flow diagram of the project boundary is presented in Figure B.3-1 below.

	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	Main emission source
		N_2O	No	Main 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	
	CO2 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	No	No reservoir in the project.
		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 Lao Power Grid), and the GHG emissions.

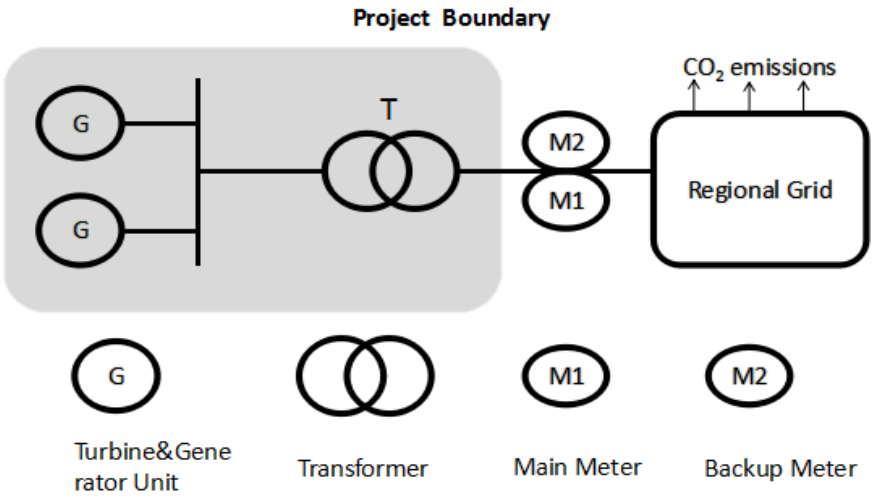

Figure B.2 Flow diagram of the project boundary

B.4. Establishment and description of baseline scenario

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According to AMS I.D., the baseline scenario is that the 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 into the grid.

The project is run-of-river hydropower project. As described in Section B.3 of the PDD, the project electricity system is a regional grid consisting of Thailand Power Grid and the Lao Power Grid. In the absence of the project, the local was/will be supplied by the above mentioned regional grid. Thus, the baseline scenario of the project is continuation of the present situation, i.e. electricity supplied from the regional power grid.

B.5. Demonstration of additionality

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The table below is only applicable if the proposed project activity is a type of project activity which is deemed automatically additional, as defined by the applied approved methodology, tool, standardized baseline or specific renewable technologies/measures conferring automatic additional microscale CDM project activities proposed by a DNA and approved by the Board.

Specify the methodology, tool, standardized baseline or specific renewable technologies/measures conferring automatic additional microscale CDM project activities proposed by DNAs and approved by the Board, that establish automatic additionality for the proposed project activity (including the version number and the specific paragraph, if applicable).	Not Applicable, as the project is a hydro power project and not auto additional.
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology, tool, standardized baselines or specific renewable technologies/measures conferring automatic additional microscale CDM project activities proposed by a DNA and approved by the Board.	Not Applicable, as the project is a hydro power project and not auto additional.

Prior consideration of CDM

According to the Feasibility Study Report (FSR) of the project had shown that the yield of the project is lower than the benchmark yield, the project development is not economically attractive to the project owner. To overcome financial weakness, and unfavourable conditions that the project encounters, the project owner decided to seek carbon revenue assistance after the project Feasibility Study Report has been completed by independent design institute. The project owner started to obtain quotations from CDM consultants. the prior consideration form was submitted to UNFCCC.

Table B.5-1 Major milestones in the development of the investment project and CDM application

Date	Detail
15 June, 2016	FSR completed
24 August, 2016	Approval from Ministry of Mine and Energy
10 February, 2017	IEE completed
8 June, 2017	Submitted the CDM Prior Consideration to UNFCCC secretary
14 August, 2017	EPC contract has been signed (starting date)

Assessment and demonstration of additionality

According to “Demonstration of additionality of small-scale project activities (Version 11.0, EB 94) ”, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barriers: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason identifies by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The additionality assessment is based on the proposition that the project faces an investment barrier would prevents its implementation. As a small hydropower project located in economically underdeveloped mountain village area, the project faces many implementation complexities, which make it hardly financial attractive. The investment barrier represents the most prohibitive factor in implementing the project. Detailed analysis is shown as follow:

The insurmountable barrier for the implementation of the project is investment barrier. According to the “Tool for the demonstration and assessment of additionality” (Version 7.0.0) approved by EB, the additionality of the projects is demonstrated and assessed through the following steps.

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind
The project is not the first-of-its-kind, its additionality is not demonstrated. So, proceed to step 1.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternative to the project activity:

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

(a) The project activity not undertaken as a CDM project activity;

(b) Construction of a thermal power plant with equivalent installed capacity or annual electricity generation;

(c) Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation;

(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 investments 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. Lao is lack in oil and natural gas resources, only coal could be produced domestically. 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 Hinboun Downstream project in Lao yet, due to the less developed mining industry and transportation system, the condition is limited for thermal power generation development in Lao, till now, the first coal-fired power plant is still under planning, the alternative b) is not a realistic alternative.

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*[6], 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 currently and lack of financial attractive to construct power plants with the similar power generation capacity with Nam Hinboun downstream 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) and (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 Sub-step 1b: demonstrates that the identified realistic and credible alternative scenarios to the project activity are Alternatives (a) and (b).

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;

[6] Prepared by Renewable Energy Technology Centre, Technology Research Institute of Lao PDR.

(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 referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by the same company used the same benchmark;

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

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

For the 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-months 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[7] at the recent 20 years before the starting date (Sep 29th 1997- Sep 25th 2017)2% 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[8];
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 uncertainly and violation of and 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 [9] 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

[7] Website of the Federal Reserve Bank of St.Louis

http://research.stlouisfed.org/fred2/series/DGS3MO?cid=47

[8] http://www.investopedia.com/terms/r/risk-freerate.asp#axzz1V9mGhc6k

[9] http://data.worldbank.org/indicator/FR.INR.RISK

interest rate 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 uncertainly, the average risk premium of Lao PDR in the latest 5 year 12.68% was adopted (the risk premium of Lao PDR from 2006 to 2010 are 11.70, 10.10, 11.70, 15.30 and 14.60resperctively).

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 14.68% (post-tax).

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

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.

Basic parameters	Unit	Value	Source
Installed capacity	MW	15	FSR
Static investment Cost	10^3USD	34,781	FSR
Fluid Capacity	10^3USD	683	FSR
Electricity Tariff	USD/kWh	0.0625	FSR
Average O&M cost	10^3USD	753	Calculated based on FSR
The annual average energy	GWh	79	FSR

The analysis shows that without the revenue of CERs, the IRR of the project will be 9.92%. Much lower than the bechmark 14.68%. The project is not financial attractive. However, the CDM revenues will help to improve the financial index (IRR with CDM revenue=12.24%).

Sub-step 2d. Sensitivity analysis

The sensitivity analysis shows whether the conclusion regarding financial attractiveness is robust to reasonable variation 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
- ✧ 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.5 Sensitive analysis of the project

Item	Variation range				
Static investment Cost	-10%	-5%	0%	5%	10%
	10.07%	10.00%	9.92%	9.85%	9.78%
Annual O&M cost	-10%	-5%	0%	5%	10%
	10.14%	10.03%	9.92%	9.82%	9.71%
Electricity tariff	-10%	-5%	0%	5%	10%
	8.49%	9.22%	9.92%	10.61%	11.28%
Power supplied	-10%	-5%	0%	5%	10%
	8.49%	9.22%	9.92%	10.61%	11.28%

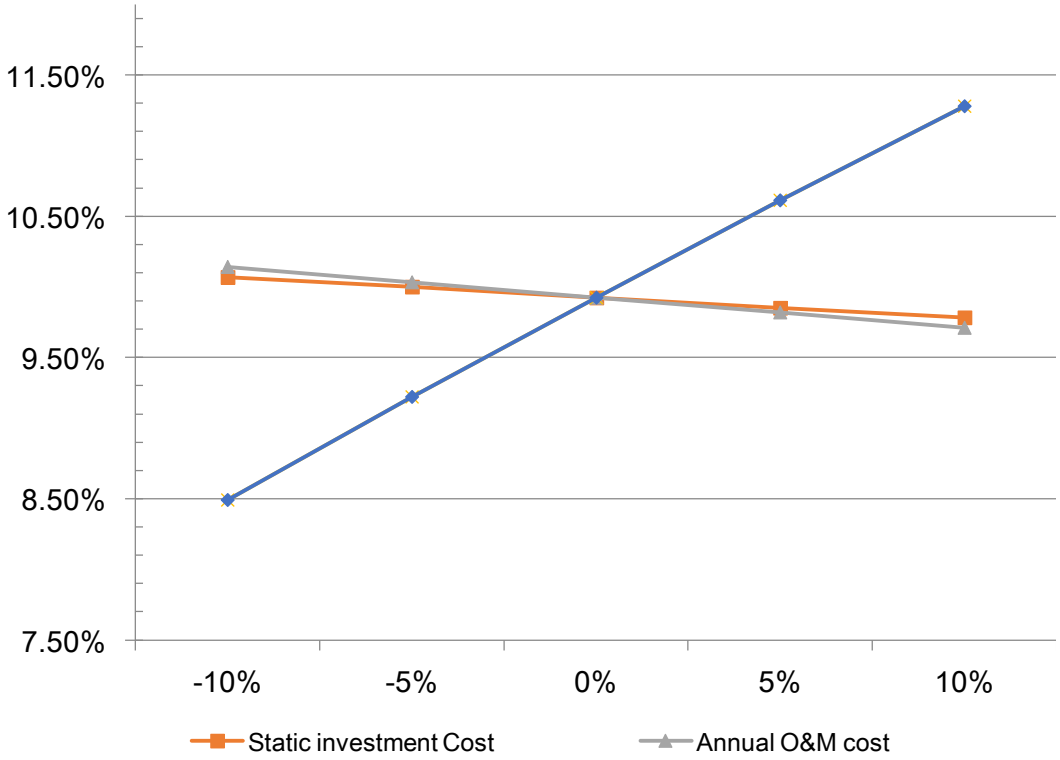

Figure B.3 Sensitive analysis

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.

The table below shows the critical point of the four parameters when the adjusted project IRR is equal to the benchmark.

Table B.6 Parameter changes when project IRR is equal to the benchmark

Item	Critical Point
Static investment Cost	-350.00%
Annual O&M cost	-240.00%
Electricity tariff	36.80%
Power supplied	36.80%

The results show that when the project IRR is equal to the benchmark value, the fixed assets investment or annual O&M costs need to be decreased by 350%, and 240% respectively, or electricity tariff or power supplied to the grid need to be increased by 36.8%. These are cases that are unlikely to occur.

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 EPC contracts, the static investment estimated in FSR has already accomplished, the EPC price is 31,200,077.76USD, which is 90% of the static investment estimated in the FSR, thus it is unlikely to decrease the investment as much as 350%.

2）Regarding to the annual O&M cost

It can be seen that even the annual O&M cost decreased to 0, the project IRR is still below 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 (EDL) for all the operation period, 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 36.8% annually.

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

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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As per the para 4 of the AMS I.D. (version 18), that methodology is applicable to project activities that:

- ✧ Install a Greenfield plant;
- ✧ Involve a capacity addition in (an) existing plant(s);
- ✧ Involve a retrofit of (an) existing plant(s); or
- ✧ Involve a rehabilitation of (an) existing plant(s)/unit(s); and
- ✧ Involve a replacement of (an) existing plant(s).

So, the project activity is Greenfield plant, option a) is applicable for the project activity. The Methodology AMS I.D (Version 18) 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.

Step 1: 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.6.1)

Where:

PE_y= Project emissions in year y (tCO_2/y);

$PE_{FF,y}$= Project emissions from fossil fuel consumption in year y (tCO_2/y);

$PE_{GP,y}$= Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/y);

$PE_{HP,y}$= Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/y);

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 $10W/m^2$:

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000} \quad \text{(Equation B.6.2)}$$

Where:

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

EF_{Res}= Default emission factor for emissions from reservoirs, and the default value as per EB 23 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 (Equation B.6.3)

The PD of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \text{(Equation B.6.4)}$$

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;

According to the FSR, the PD is greater than $10W/m^2$, thus $PE_{HP,y}$= 0. Then PE_y= 0 tCO_2.

Step2: Calculate the baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in 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:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$ (Equation B.6.5)

Where:
BE_y= Baseline emissions in year y (tCO_2)

$EG_{PJ,y}$= 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)

$EF_{grid,CM,y}$= Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

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:
$EG_{PJ,y}=EG_{facility,y}$ (Equation B.6.6)

Where:

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

Calculate the Combined margin CO_2 emission factor

The emission coefficient (measured in tCO_2e/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 05.0).

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

- ✧ Step 2.1: Identify the relevant electricity systems;
- ✧ Step 2.2: Choose whether to include off-grid power plants in the project electricity system (optional);
- ✧ Step 2.3: Select a method to determine the operating margin (OM);
- ✧ Step 2.4: Calculate the operating margin emission factor according to the selected method;
- ✧ Step 2.5: Calculate the build margin (BM) emission factor;
- ✧ Step 2.6: Calculate the combined margin (CM) emission factor.

Step 2.1: Identify the relevant electricity systems

The DNA of Lao has published a delineation[10] 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 *b*y Lao DNA, is a part of the regional power grid consisted by Lao and Thailand power grid. Therefore, the relevant electricity system is the

[10] See Calculation for the emission factor for electricity generation in Lao PDR, 2010

regional power grid including Lao Power Grid and Thailand Power Grid. And the connected electricity system is Malaysia, China and Vietnam Power Grid11[11].

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

Project Investor may choose between the following two options to calculate the operating margin and build margin emission factor:

- ✧ Option 1: Only grid power plants are included in the calculation.

- ✧ Option 2: Both grid power plants and off grid power plants are included in the calculation.

option 1 is chosen for operating margin and build margin emission factor calculation.

Step 2.3: Select a method to determine the operating margin (OM)

According to "Tool to calculate the emission factor for an electricity system" (Version 05.0), there are four methods for calculating the $EF_{grid,OM,y}$:

- ✧ Simple OM, or
- ✧ Simple adjusted OM, or
- ✧ Dispatch Data Analysis OM, or
- ✧ Average OM

The method (d), average OM, is selected.
$EF_{grid,OM\text{-}ave,y}$ 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 2.4: Calculate the operating margin emission factor ($EF_{grid,OM,y}$) 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 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 05.0)", there are two options based on different data for calculating average OM:

- ✧ Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
- ✧ Option B: Based on the 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.

[11] 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).

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:

$$EF_{grid,OM-ave,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_y} \quad \text{(Equation B.6.7)}$$

Where:

$EF_{grid,OM-ave,y}$= Average operating margin CO_2 emission factor in year y (tCO_2/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);

$EF_{CO2,i,y}$= CO_2 emission factor of fossil fuel type i in year y ($t\ CO_2/GJ$);

EG_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 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", electricity imports from the connected electricity system $EG_{import,y}$ are included in the EG_y.

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

Step 2.5: Calculate the build margin (BM) emission factor

To calculate the build margin (BM) emission factor, the data for determine the same 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 2.6: Calculate the combined margin (CM) emission factor

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

- ✧ Weighted average CM; or
- ✧ Simplified CM.

According to "Tool to calculate the emission factor 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; and also 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:

$EF_{grid,CM,y}=W_{OM}\times EF_{grid,OM,y}+EF_{grid,BM,y}\times W_{BM}$ (Equation B.6.8)

Where:

$EF_{grid,CM,y}$= Combined margin CO_2 emission factor in year y (tCO_2/MWh);

$EF_{grid,OM,y}$= Build margin CO_2 emission factor in year y (tCO_2/MWh);

$EF_{grid,BM,y}$= Operating margin CO_2 emission factor in year y (tCO_2/MWh);

W_{BM}= Weighting of operating margin emission factor (%);

W_{OM}= Weighting of build margin emission factor (%);

The weights W_{OM} and W_{BM}, for simplified CM by default, are W_{OM}=1 and W_{BM}=0.

Step3: Calculate the project leakage

No leakage emissions are considered.

Step4: Calculate the emission reductions

Emission reductions are calculated as follows:
$ER_y=BE_y-PE_y$ (Equation B.6.9)

Where:
ER_y=Emission reduction in year y (tCO_2e/y);

BE_y=Baseline emission in year y (tCO_2e/y);

PE_y=Project emission in year y (tCO_2e/y);

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$FC_{i,y}$
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	Calculation for the emission factor for electricity generation in Lao PDR,2010
Value(s) applied	Refer to Appendix 4 for details.
Choice of data or Measurement methods and procedures	Data used are from Thailand DNA and Lao PDR.
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	$NCV_{i,y}$
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	Electric Power in Thailand 2010
Value(s) applied	Refer to Appendix 4 for details.
Choice of data or Measurement methods and procedures	Data used are from Thailand authorities, DEDE
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	$EF_{CO2,I,y}$
Unit	tCO_2/TJ
Description	The CO_2 emission factor per unit of fuel i in year y
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Chapter 1 Table 1.4
Value(s) applied	Refer to Appendix 4 for details.
Choice of data or Measurement methods and procedures	No specific local value available, the value form IPCC 2006, Guidelines for National Greenhouse Gas Inventories was adopted.
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	EG_y
Unit	GWh
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	Calculation for the emission factor for electricity generation in Lao PDR, 2010
Value(s) applied	Refer to Appendix 4 for details.
Choice of data or Measurement methods and procedures	Data used are from Thailand DNA, TGO.
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	$EG_{import,y}$
Unit	MWh
Description	The electricity(MWh) imported from Malaysia, China and Vietnam Power Grid in year y.
Source of data	Electricity report by EGAT(2010,2009,2008)
Value(s) applied	See Appendix 4 for details.
Choice of data or Measurement methods and procedures	Data used are from Thailand authority, EGAT and Lao authority, EDL
Purpose of data	Baseline emission
Additional comment	-

Data / Parameter	A_{BL}
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
Source of data	Project on-site
Value(s) applied	0
Choice of data or Measurement methods and procedures	For new reservoirs, this value is zero.
Purpose of data	Project emission
Additional comment	-

Data / Parameter	CAP_{BL}
Unit	MW
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	Project on-site
Value(s) applied	0
Choice of data or Measurement methods and procedures	For new hydro power plants, this value is zero.
Purpose of data	Project emission
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

>>

Project Emission (PE)

PE_y=0 tCO_2e

Baseline Emission (BE)

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

$EF_{grid,CM,y}=W_{OM}\times EF_{grid,OM,y}+EF_{grid,BM,y}\times W_{BM}$=0.5595 tCO_2e/MWh

The baseline emission of the project:

$\mathbf{BE_y=EG_{PJy}\times EF_{grid,CM,y}}$=79,000×0.5595=44,200 tCO_2e

Project Leakage (PL)

No leakage emissions are considered.

Emission Reductions (ER)

$ER_y=BE_y-PE_y$=44,200-0=44,200 tCO_2e

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
01/01/2020-31/12/2020	44,321[12]	0	0	44,321
01/01/2021-31/12/2021	44,200[13]	0	0	44,200
01/01/2022-31/12/2022	44,200	0	0	44,200
01/01/2023-31/12/2023	44,200	0	0	44,200
01/01/2024-31/12/2024	44,321	0	0	44,321
01/01/2025-31/12/2025	44,200	0	0	44,200
01/01/2026-31/12/2026	44,200	0	0	44,200
Total(t CO_2e)	309,642	0	0	309,642
Total number of crediting years	7			
Annual average over the crediting period	44,235	0	0	44,235

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter	$EG_{facility,y}$
Unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Calculated value
Value(s) applied	$EG_{facility,y}=EG_{output,y} - EG_{input,y}$
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	$EG_{output,y}$
Unit	GW
Description	Electricity supplied by the project to the grid in year y
Source of data	Measured by meters M1 and M2
Value(s) applied	79
Measurement methods and procedures	Continuous measurement and monthly recording
Monitoring frequency	Continuously
QA/QC procedures	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.
Purpose of data	Baseline Emission Calculation

[12] The period of first years covers 01/01/2020-31/12/2020, thus the baseline emission (prorated on the basis of the actual number of days (366 days, from 01/01/2020-31/12/2020)is 79,000 MWh/yr*0.5595 tCO_2/MWh=44,200/365*366=44,321 tCO_2/yr.

[13] The period of first years covers 01/01/2021-31/12/2021, thus the baseline emission (prorated on the basis of the actual number of days (365 days, from 01/01/2021-31/12/2021)is 79,000 MWh/yr*0.5595 tCO_2/MWh=44,200 tCO_2/yr.

Additional comment	-

Data / Parameter	$EG_{input,y}$
Unit	MWh
Description	The electricity used by the project and input from the grid in year y
Source of data	Measured by meters
Value(s) applied	Estimated to be 0 MWh for ex-ante calculation
Measurement methods and procedures	Continuous measurement and monthly recording
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures	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.
Purpose of data	Baseline emission
Additional comment	

Data / Parameter	Cap_{PJ}
Unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Value(s) applied	15
Measurement methods and procedures	Use the data in the FSR at start of the project. Measure by check the nameplate after operation
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Purpose of data	Project emission
Additional 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:

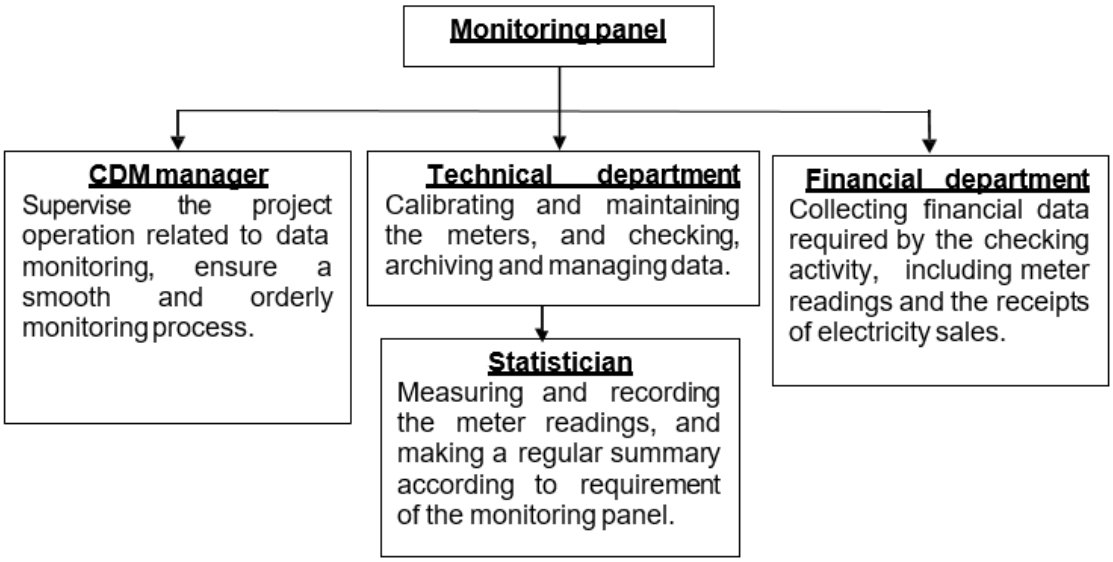

Figure B.4 Organization structure of the monitoring activity

2. Monitoring apparatus and installation

The meter(s) will be installed at the project site, to monitoring the input/output electricity at the grid side. The meter(s) will be installed in accordance with relevant national or international standard. As the project is still under construction, the monitoring meters have not been installed yet, therefore the serial numbers of meters are not available. Before the operation of the project, the metering equipment(s) 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

The calibration frequency of the monitoring meters will be annually. The accuracy of the monitoring meters will not less than 0.5. 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 operate 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.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Date of completion of application of methodology and standardized baseline:
5/1/2018
Responsible persons/ entities:
Ms. Su Jiaofang
jiaofang.su@htne-tech.com
HT New Energy Technology (Shanghai) Co.,Ltd.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
14/8/2017(EPC contract has been signed)

C.1.2. Expected operational lifetime of project activity

>>

40 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

>>

1/1/2020 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 Initial Environmental Examination (IEE) for the 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 Impact

The waste water is not allowed to be discharged into River directly in order to protect the water quality. The wastewater generated from operations of construction equipment and machinery as well as vehicle services, and from toilet waste and domestic sewage. The mitigation measures in construction phase and operation phase are as following:

Construction phase

Install sedimentation ponds to collect runoff from concrete preparation and construction sites.

Prevent washing of excess concrete / cement from vehicles or equipment adjacent to or in streams. Use of designated wash down area is recommended.

Strictly control the use of fuel and other hydrocarbon products such as grease, oils and lubricants to prevent leachate or run-off that can cause soil and water contamination.

Use of chemicals (if any) will be strictly controlled to prevent potential water contamination.

Septic tank will be installed for toilet waste and sewage; kitchen waste water will be trapped in specially covered pond and treated before release to prevent potential eutrophication of streams and water bodies.

Operation phase

Wastewater treatment systems need to be installed at each site to collect and treat raw sewage from various sources including toilets, showers, basins and kitchen facilities. These systems need to be maintained throughout the operation phase to enable the treatment of wastewater from all permanent site facilities.

Solid waste that is generated during the operation phase should be segregated for reuse and recycling, where possible, in preference to on site disposal. All remaining waste (that cannot be reused or recycled) needs to be disposed of appropriately.

Air Quality Impact

The sources of air emission and fugitive dust will likely be from the blasting, drilling, crushing, and hauling associated with the above activities. The mitigation measures are as following:

Construction phase

Watering the exposed road surface area or unsealed haul roads is essential at least twice (2) daily in the dry season, or as often as the condition warrants to contain the emission of dust. Clearing of unnecessary area should be minimized to reduce exposed dusty surface.

Dump truck loads of cement, sand, spoils, gravels or other construction materials must be properly covered while travelling on the public roads and through community areas.

Keep land clearing and topsoil removal to a minimum and rehabilitate cleared land will be rehabilitated as soon as practicable.

Operation phase

There are no expected impacts on air quality from the Project.

Noise and Vibration Impact

the operation of heavy equipment, machinery and heavy trucks will generate noise. To reduce potential noise impact on the communities and the construction workers, the following specific mitigation measures are proposed:

Construction phase

While dealing with noise level is important in general, of special attention will be the mitigation of noise level within the 100m radius from the source, and to a lesser extent within the 100-200m zones.

It is important that the construction equipment, machinery and technology used meet acceptable standards in terms of noise emission level. Proper machinery and equipment maintenance is also critical to reduce noise level.

Project activities shall be carried out within the hours of 06:00 – 18:00, Monday to Saturday. Project activities should not be carried out on Sundays or public holidays unless special permit is granted on a case by case basis by the local authorities or responsible agency.

Especially noisy night shift work should be limited if not disallowed. If critically necessary, prior consultation and agreement with the local authorities and communities must be sought before proceeding, but work should not go beyond 11:00pm.

Transportation in service of the construction should be limited to the daytime, avoid extensive horning.
It is important to consider the restriction on high music sound level from the labour camp at night since the camp is located relatively close to the residential areas.

Operation phase

As there are no expected impacts on noise or vibration from Project, no avoidance, mitigation and management measures have been proposed.

Impact on forest resources and terrestrial biodiversity

The project area is of predominantly secondary and disturbed forestland and patches of remnant woodland. There is no presence of primary forest nor are there any NPAs, PPAs or DPAs located within or nearby the Project area. For this reason, direct project impact on sensitive forest areas and resources will be minimal during the construction phase and negligible during operation. These village conservation forests will, among other uses, provide habitats for wildlife and healthy forest ecosystem services. At the same time, presence of the workforce should not result in increased pressures on the local harvest and use of NTFPs.

Mitigation Construction phase

Management and mitigation of potential adverse impacts on forest resources and biodiversity will be handled as follows:

No wood cutting will be permitted in village forest areas for fuelwood or construction materials. All wood required for the dam construction and used by the workforce will be supplied from legitimate sources outside the project area.

The Developer shall plan and conduct project related activities within the identified perimeter of the allocated land, for which the Developer will have a land clearing and monitoring plan.

The Project, in association with the Hinboun DAFO and Khammouane PAFO, can help the local administrations in protecting their forest resources and wildlife habitats, including the village protected areas by providing support to awareness raising and monitoring need as an effort to contribute to conserving biodiversity. If necessary, support should be provided to village protected area (conservation forest) boundary delineation marking by supplying the posts.

To minimise noise and vibration impacts on wildlife, ensure that all equipment incorporates industry standard noise reduction systems and comply with applicable noise standards where practicable.

Operation phase

Prohibit staff and contractors from hunting, buying or trading of wildlife as well as the collection of timber and NTFPs to help conserve existing fauna and forest resources.

Periodic monitoring of habitat and key wildlife species to assess whether any further mitigation or management measures will be conducted.

Impact on general waste and hazardous materials

The generation of general waste materials at the Project will result from construction activities, administration, procurement and general camp maintenance and operation.

Mitigation Construction phase

Solid waste and rubbish must not be littered carelessly or burnt on site in the camp while waste water from kitchen and sewage must be properly contained and disposed of and buried at a specified agreed site.

Minimise the volume of waste generated by procuring supplies that produce less waste by virtue of the way they are produced, packaged or consumed.

Maximise recycling and reuse.

Chemical and hazardous waste should be separated and disposed of separately. Specially hazardous and dangerous waste must be packed in special container to be transported for disposal according to standard procedure and guidelines.

Maintaining an inventory of hazardous materials on site.

Designed facilities will be constructed to manage non-hazardous wastes on site including:

- Storage and separation area for recyclables;
- Residue waste landfill for non-recyclable, non-hazardous materials;
- Biodegradable composting pits; and
- Sewage and greywater treatment plants.

Mitigation Operation phase

Maximise recycling and reuse.

Solid, chemical and hazardous waste should be segregated and stored properly.

All waste will be disposed properly.

In conclusion, the proposed project will not bring significant negative impact to the environment.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

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In order to develop the project as a Gold Standard CDM project a Local Stakeholder Consultation Meeting which is in line with Gold Standard Requirements was held in July 2017, before the construction started.

Stakeholders were invited to attend the meeting through different means including:

- Personal face to face invitations to government officer
- E-mail correspondence
- Invitation letter posted on the village Bulletin Board

Local people were invited to the meeting via personal face to face invitations and posters. Local government officers were invited to the meeting via face to face invitations and invitation letter. In addition, NGOs were invited to the meeting via e-mails sent.

Finally, 37 stakeholders participated in the meeting. The meeting was opened by the introduction of the project developers and the representative from the project owner company. The objective of the meeting was based on the non-technical summary, Environmental Management Plan and draft Passport Report of the project. Also, how the project might have some environmental effects, how these issues will be mitigated by the investor and also climate change and how the project will help the fight against climate change were discussed.

During the invitation process and the stakeholder meeting, the evaluation forms were handed out and the stakeholder were asked for their comments and requests about the project. The questions of the stakeholders were responded during the consultation meeting and their requests were assessed.

The detailed information can be found in LSC Report of the project.

E.2. Summary of comments received

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During the consultation meeting, stakeholders comments were positive about the Project. Stakeholders had some comments about the project and asked for some contributions from the project owner. The main issues raised by the participants during the meeting were:

- Water quantity
- Job opportunities
- Waste water
- Land occupy
- Technology reliable
- Air quality
- the protection of biodiversity

(Please refer to the LSC Report of the project for the details of the Stakeholder assessments.)

E.3. Report on consideration of comments received

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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

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The letter of approval from the parties are not obtained yet.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Rasita Power Co., Ltd
Street/P.O. Box	Songhong Village, Hinboun District, Khammouane Province, Lao PDR
Building	
City	Hinboun
State/Region	Hinboun District
Postcode	
Country	Lao PDR
Telephone	+856 20 55511731
Fax	+856 21 414459
E-mail	rasita@live.cn
Website	https://rasitapower.com/
Contact person	
Title	General manager
Salutation	Mr.
Last name	Somphone
Middle name	
First name	Oudone
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	South Pole Carbon Asset Management Ltd.
Street/P.O. Box	Technoparkstrasse 1
Building	
City	Zurich
State/Region	
Postcode	8005
Country	Switzerland
Telephone	+41 43 501 35 50
Fax	+41 43 501 35 99
E-mail	info@southpolecarbon.com
Website	www.southpolecarbon.com
Contact person	Renat Heuberger
Title	
Salutation	Mr.
Last name	Heuberger
Middle name	
First name	Renat
Department	
Mobile	
Direct fax	+41 43 501 35 99
Direct tel.	+41 43 501 35 99
Personal e-mail	r.heuberger@southpolecarbon.com

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 methodology and standardized baseline

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 Consumption	Fuel Specific EF	Net Calorific Value	GHG emission

Fuel Type	$FC_{i,y}$		$EF_{CO2,m,i,y}$	$NCV_{i,y}$	$FC_{i,y}$ x $EF_{CO2,m,i,y}$ x $NCV_{i,y}$/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 EFgrid,OM-ave,y =0.5595 tCO2/MWh

$EF_{grid,CM,y}=w_{OM}\times EF_{grid,OM,y}+w_{BM}\times EF_{grid,BM,y}$
= 1×0.5595
= 0.5595 tCO_2e/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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Document information

Version	*Date*	*Description*
08.0	22 July 2016	EB 90, Annex 2 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for small-scale CDM project activities (these instructions supersede the "Guidelines for completing the project design document form for small-scale CDM project activities" (Version 01.1)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and **错误! 未找到引用源。**; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-SSC-PDD-FORM*; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	13 March 2012	EB 66, Annex 9 Revision required to ensure consistency with the “Guidelines for completing the project design document form for small-scale CDM project activities”
03.0	15 December 2006	EB 28, Annex 34 • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02.0	08 July 2005	EB 20, Annex 14 • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01.0	21 January 2003	EB 07, Annex 05 Initial adoption.

Version	*Date*	*Description*

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