Project design document form for small-scale CDM project activities

(Version 05.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Nam Samoy Hydropower Project
Version number of the PDD	2.0
Completion date of the PDD	12/12/2014
Project participant(s)	Nam Samoy Hydropower Co., Ltd. Swiss Carbon Assets Limited
Host Party	Lao PDR
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope 1: Energy Industries. Baseline methodology: AMS I.D. - Grid Connected Renewable Electricity Generation
Estimated amount of annual average GHG emission reductions	15,666 t CO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Nam Samoy Hydropower Project (hereafter referred to as the "the project") is located on the Nam Samoy River, Vientiane Province, Lao PDR, developed by Nam Samoy Hydropower Co., Ltd.

The project is a run-of-the-river hydropower station. The installed capacity is 5MW, with annually 28GWh power supplied to the power grid.

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 15,666 t CO_2e 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;
- 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 slow 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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Vientiane Province

A.2.3. City/Town/Community etc.

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Kasy District

A.2.4. Physical/ Geographical location

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The Project site is located at located on the Nam Samoy River, Vientiane Province, Lao PDR. The approximate coordinates of the project site (power house) is: 19.2953°N, 102.3441°E. The approximate coordinates of the project site (intake) is: 19.2958°N, 102.3443°E.

Figure A.1 Show the location of the project:

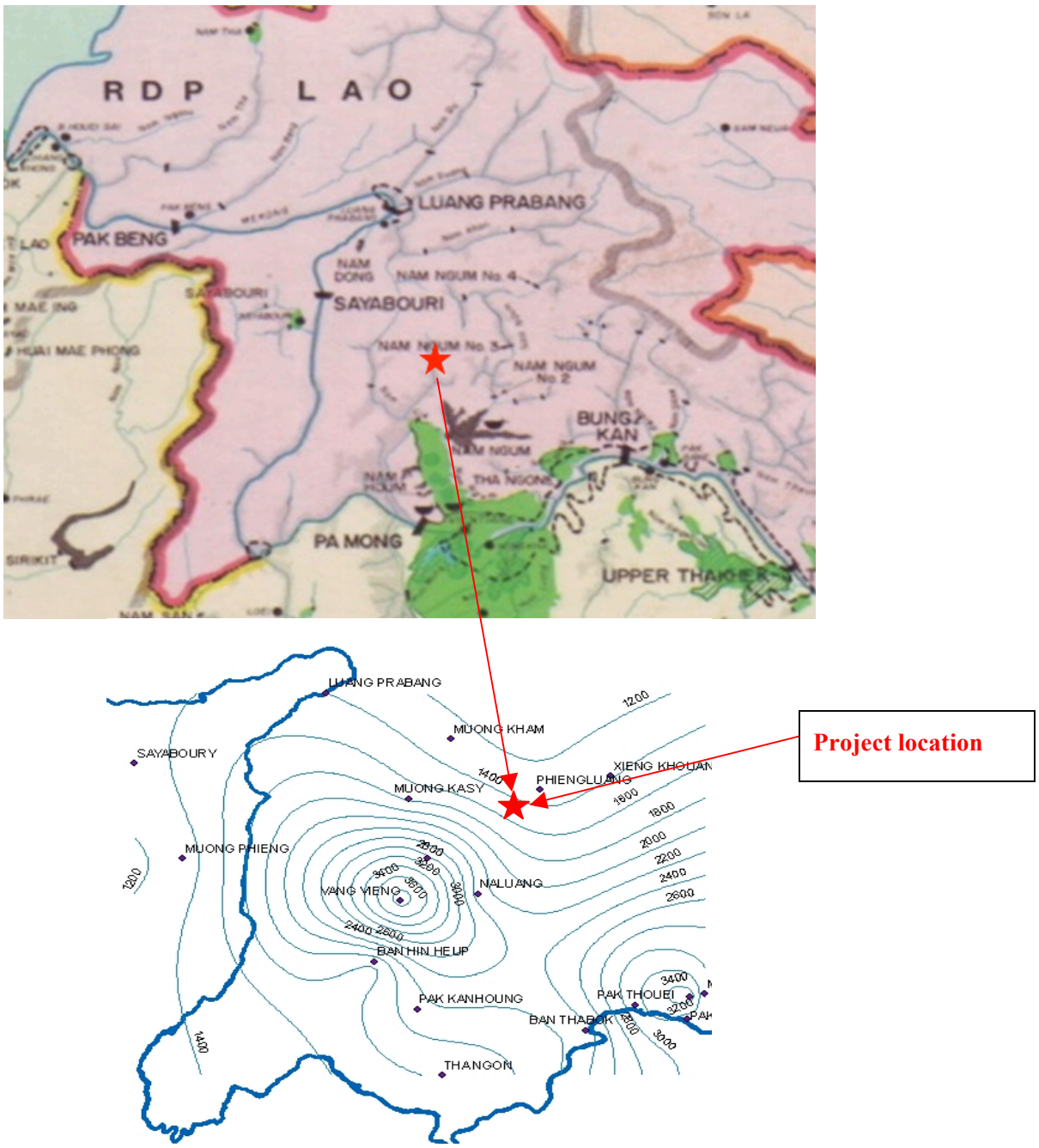

Figure A.1. Location of the project

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 Project is a run-of-river hydropower project. The total install capacity of the project is 5MW. The construction of the project includes fixed weir, a sand flush, intake, headrace channel, head

tank, penstock, powerhouse and a tailrace. The annual net electricity supply for the project will be 28GWh. The power generated will be delivered to EDL.

According to the FSR, the main parameters as follows:

For turbine	Type:	Horizontal Pelton or Cros flow
	Number of units:	2
	Rated output:	2,627 kW
	Designed discharge:	1.80 m^3/s
	Gross head (max):	400.00 m
	Gross head (min):	388.00 m
	Net head (max):	360.00 m
	Net head (min):	349.20 m
	Rated speed:	1,000 rpm
For generator	Type:	Horizontal shaft
	Number of units:	2
	Installed capacity	2,500 kW
	Rated Voltage	6,300 V
	Frequency	50 Hz
	Rated speed:	1,000 rpm
	Power factor	0.90
	Energy product	28 GWh
	Plant load factor	64%

A.4. Parties and project participants

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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)	Nam Samoy Hydropower Co., Ltd. (Project owner)	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 Guidelines on Assessment of Debundling for SSC Project Activities (Version 03, EB54, Annex13), a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(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 1 km 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

B.1. Reference of methodology

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Baseline methodology:

AMS I.D. Grid connected renewable electricity generation (Version 17, EB 61).

This methodology draws upon the following tools:

Guidelines for demonstrating additionality of microscale project activities (Version 5.0, EB 73) and Tool to calculate the emission factor for an electricity system (Version 4.0, EB 75)

And the Approved consolidated baseline and monitoring methodology ACM0002 (Version 14.0, EB 75): "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/SSCmethodologies/approved

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 17):

- The project makes use of renewable water resources to generate electricity to the regional grid consisting of Thailand Power Grid and 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);
- There is no reservoir for the project, thus there is no power density of the project;
- The total installed capacity of the project is 5 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

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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 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 the "*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.

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[1]. So, the electricity system don 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[2]	6,938.45	2,385.84	2,315.43
Domestic demand in Lao[3]	2,228.15	1,901.29	1,577.86
Lao power import from Thailand (EDL)[4]	1,042.12	1,081.19	772.8

[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, Electricite du Laos.

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

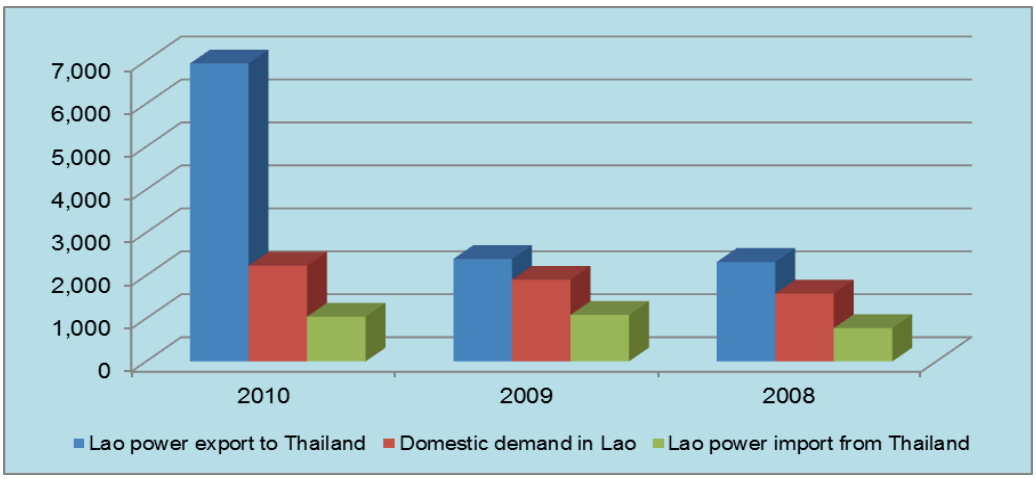

Figure B.1 Power exchange between Lao and Thailand (Unit: GWh)

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[5]. 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	No	Minor emission source

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

		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.

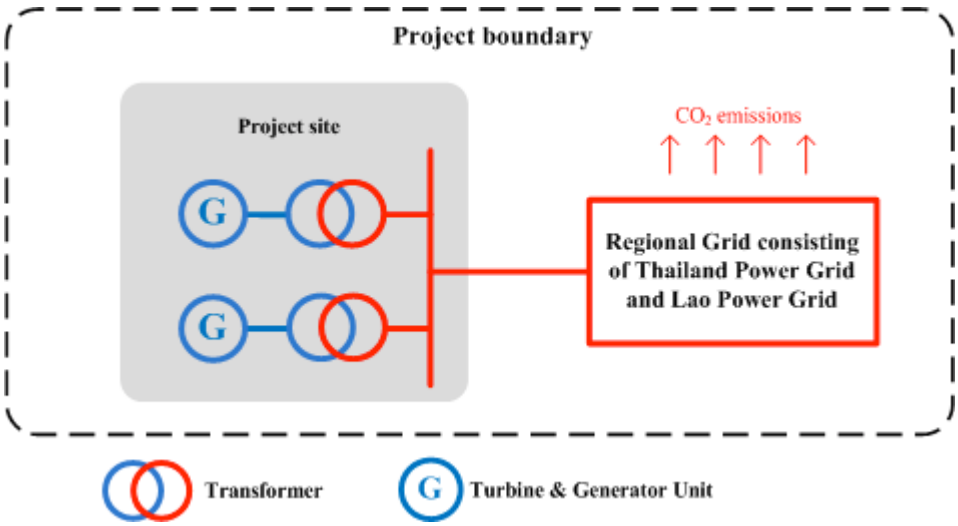

Figure B.2 Flow diagram of the project boundary

B.4. Establishment and description of baseline scenario

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According to ASM 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.

B.5. Demonstration of additionality

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The additionality of the Project could be assessed according to the UNFCCC-approved additionality demonstration criteria of "Microscale Project Activity" per Guidelines for demonstrating additionality of microscale project activities (Version 05.0).

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 Feb of 2013, and in the 08/01/2014, the prior consideration form was submitted to UNFCCC, and meanwhile, the PO notified the Lao DNA.

The project is currently in construction stage. The first signed agreement regarding project implementation is the "Civil Work Contract" which is signed on 27/01/2014. According to the start date of the project's definition, "Start date of the project means the earliest date at which either the implementation or construction or real action of a project begins", the project start date is defined as 27/01/2014.

According to Paragraph 8(a), Project activities up to five megawatts that employ renewable energy technology are additional if the geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country, which can be summarized as follow in accordance with the Project situation:

(i) The installed capacity of the project is up to 5 MW
The installed capacity of the project is 5 MW, which is no more than 5 MW.

(ii) The project activity is located in LDCs/SIDs
Lao PDR is one of the 49 least developed countries[6] published by Committee for Development Policy (CDP).

Therefore, the condition 8(a) is satisfied. Thus, the project is deemed to be additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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The Methodology AMS I.D (version 17) 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:

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

Where:

PE_y	Project emissions in year *y* (tCO_2e/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 10 W/m^2:

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

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

[6] http://www.unohrlls.org/en/ldc/25/

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

The PD of the project activity is calculated as follows:

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

According to the FSR, there is no reservoir for the project that does not result in a new reservoir, thus $PE_{HP,y}=0$. Then $PE_y=0$ tCO_2.

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:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$ (Equation B.5)

Where:

BE_y	Baseline Emissions in year *y* (tCO_2/y);
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh/y);
$EF_{CO2,grid,y}$	CO_2 emission factor for the grid in year *y* (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:

$$EG_{BL,y}=EG_{facility,y}$$ (Equation B.6)

<u>Calculate the Combined margin CO_2 emission factor</u>

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 04.0).

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[7] 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[8].

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 04.0), 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 04.0), 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

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 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*, 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

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

[8] 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).

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.

The necessary data for Option A is not available, so Option B can be 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:

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

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* (tCO_2/GJ)
EG_y	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* (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 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

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; 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:

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

Where:

$EF_{grid,CM,y}$	Combined margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	Weighting of operating margin emission factor (%);
w_{BM}	Weighting of build margin emission factor (%).

Where, w_{BM}= 0, w_{OM}= 1.

Thus $EF_{CO2,grid,y} = EF_{grid,CM,y}$ =0.5595 tCO_2/MWh.

Calculate the project leakage

No leakage emissions are considered.

Calculate the emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{(Equation B.9)}$$

Where:

ER_y	Emission reduction in year *y* (t CO_2e/y);
BE_y	Baseline emission in year *y* (t CO_2e/y);
PE_y	Project emission in year *y* (t CO_2e/y).

B.6.2. Data and parameters fixed ex ante

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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.
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	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	*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)* *EDL Annual Report 2012*
Value(s) applied	Refer to Appendix 4 for details.
Choice of data or Measurement methods and procedures	Data used are from Thailand authorities, EGAT.
Purpose of data	Baseline Emission Calculation
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 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 Calculation
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 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 Calculation
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

>>

Project emission

PE_y=0 tCO_2e

Baseline emission

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

$EF_{CO2,\,grid,\,y} = EF_{grid,\,CM,\,y} = w_{OM} \times EF_{grid,\,OM,\,y} + w_{BM} \times EF_{grid,\,BM,\,y}$=0.55950 tCO_2e/MWh.

The baseline emission of the project:

$BE_y = EG_{BL,y} \times EF_{CO2,grid,y}$= 28,000 ×0.55950=15,666 tCO_2e

Project leakage

No leakage emissions are considered.

Emission reductions

$ER_y = BE_y - PE_y$ =15,666 – 0 = 15,666 tCO_2e

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

>>

Year	Baseline emissions (tCO2 e)	Project emissions (tCO2 e)	Leakage (tCO2 e)	Emission reductions (tCO2 e)
Year 1	15,666	0	0	15,666
Year 2	15,666	0	0	15,666
Year 3	15,666	0	0	15,666
Year 4	15,666	0	0	15,666
Year 5	15,666	0	0	15,666
Year 6	15,666	0	0	15,666
Year 7	15,666	0	0	15,666

Total	109,662	0	0	109,662
Total number of crediting years	7			
Annual average over the crediting period	15,666	0	0	15,666

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

>>

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 ($EG_{facility,y} = EG_{output,y} - EG_{input,y}$)
Value(s) applied	28,000
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
Additional comment	-

Data / Parameter	$EG_{output,y}$
Unit	MWh
Description	Electricity supplied by the project to the grid in year *y*
Source of data	Measured by meters
Value(s) applied	28,000
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
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	0 MWh for ex-ante calculation
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 by 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
Additional comment	-

Data / Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Value(s) applied	5,000,000
Measurement methods and procedures	The data will be determined and recorded based on nameplates of the generators or equipment contract yearly.
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	Project Emission Calculation
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:

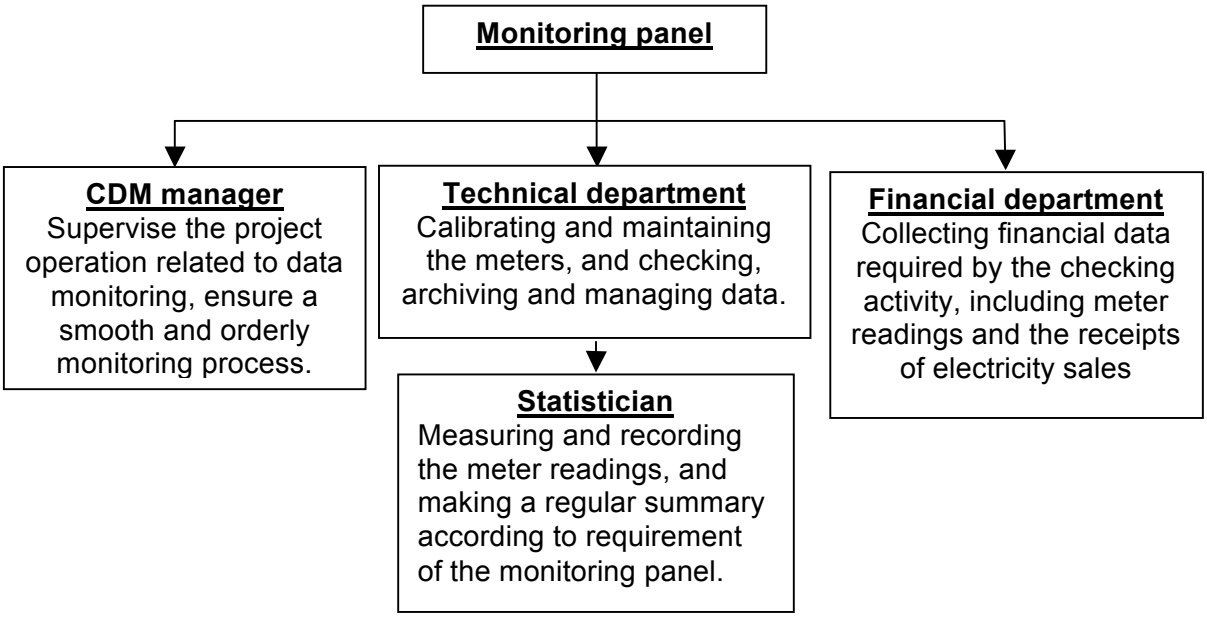

Figure B.3. Organization structure of the monitoring activity

2. Monitoring apparatus and installation:

- Electricity exported to/import from the grid

The main and back-up metering equipment will be installed at the project site and calibrated annually for accuracy. The calibration will be done according to the national and/or local standards and regulations by professional personnel. The accuracy of the meters will be no more than 0.5. The metering equipments will be checked by the project owner and the EdL before operation. The grid company will be responsible for the operation and maintenance of the metering device.

- Installed generation capacity

The installed generation capacity of the project will be monitored yearly in accordance with the nameplate of the generator.

3. Data collection:

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

a) The meters will be calibrated according to the relevant regulation and request of EdL.
b) The project owner and the grid company will record both output and input power readings. These data will be used to calculate the amount of net electricity delivered to the grid.
c) The meter's readings will be cross-checked with record document confirmed by EdL.
d) The project owner will be responsible of providing copies of record document confirmed by EdL to the DOE for verification.

If the reading 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:

e) Project owner and grid company 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.
f) 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 should be implemented according to relevant standards and rules accepted by the grid company EdL.

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 be 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.

B.7.4. 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:
12/12/2014

Responsible persons/ entities:
Mr. Lu Yaodong
Beijing Karbon Energy Consulting Co., Ltd.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
27/01/2014 (Civil Work Contract)

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

>>
01/09/2015 or registration date, whichever is the latest date.

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 with Environmental Management Plan for Nam Samoy 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:

Construction Phase

Wastewater

The waste water is not allowed to be discharged into River directly in order to protect the water quality. The wastewater generated from disturbed, erosion prone land (i.e. construction camps, quarries, borrow pits and spoil dumps) will be treated employing the following mitigation measures according to the EIA report:

- Dirty water from erosion-prone land will be collected in interception channels and, if necessary, directed to sedimentation ponds, prior to being released to the environment;
- Septic sanitation facilities will be provided to construction and camp areas. No untreated human waste is allowed to enter any watercourse to affect water quality, aquatic environments and human health.
- All hydrocarbons (e.g. fuels and lubricants) and chemical reagents will be stored in safe places, fully bundled areas constructed and managed in accordance with relevant International Standards and Material Safety Data Sheets. Oil, fuel and lubricant storage areas should be located well away from any water courses. Project Developer will ensure that containers of reagents and drums of used oil or grease are stored under cover at all times;
- Potentially oil runoff from areas such as vehicle maintenance bays, equipment lay down areas, or refuelling stations will be contained by perimeter bundling or interception drains. Oil runoff will be directed through oil/water separators prior to discharge to the environment. Oil/water separators will be regularly cleaned and maintained.

Exhaust gases and dust

Exhaust gases resulting from vehicles, construction equipments and the dust generating from the construction activities is the greatest threaten of air quality. Dustproof measures are employed including watering and dust collecting, wet construction method will be used to minimize the negative impact and those construction equipment and vehicles in compliance with relevant sanitary regulations will be selected and properly conserved. Furthermore, dustproof respirator will be applied to protect the respiratory tract of the workers on site who are granted to be the main casualties. Attribute to the methods mentioned above, the negative impact on air quality is confined into the construction site during the construction period and can be neglected.

Solid and Liquid Waste

Waste management procedures will be based on the following hierarchy (in decreasing order of preference): (i) Minimize the waste production and maximize waste recycling and reuse; and (ii) Promote safe waste disposal.
To minimize waste production, a lot of mitigation measures will be taken including maximizing the efficiency of all on-site activities, supplying products with less waste produced and using no-hazardous materials. Project owner will educate staff, contractors to minimize litter generation and procedures will be established for segregating different types of waste at the location where they are generated to maximize the recovery of recyclables.

Noise and vibration

The area of construction, including quarries should have restricted working hours, including restricted times for above ground blasting. Construction workers exposed to noise levels of 70-80 dB or more than will be provided with adequate hearing protection, in accordance with the requirements of the health and safety plan. The exhaust and radiator silencers will be fitted to construction equipment, in particular, trucks and loaders. Construction activities and use of heavy vehicles will be minimized during night time. Emissions from reversing alarms may be regulated to reduce intrusiveness, particularly at night.

Impacts on ecosystem

Soil and water erosion might be induced attribute to slope exploration, earth-and-rock excavation, and the utilization of dumpsites. Rehabilitation of vegetation and other technique methods will be conducted to minimize the negative impact once the construction activities completed.

Lands will be occupied permanently due to the construction of water retaining dam, access road, dumpsites and livelihood areas, however, due to the severe vegetation deterioration, the soil is poor with low coverage rate of vegetation. Therefore, the induced ecosystem loss is minimum.

No cultural relic, mineral or protected plant were identified during the environment survey, and no extinction of plant will be induced. Hence, the impact to local ecosystem attribute to the transformation of land use is insignificant.

As the construction site is far away from nearest village, the proposed project will not result in any displacement of residents and inundation of houses.

Operation Phase

Waste water

The wastewater mainly generated from the permanent staffs during the operation phase is not allowed to be fed into the river directly. It is designed that the domestic sewage should be disposed using the advanced integrated treatment equipment to minimize the impacts on local environment.

Water quality and quantity

Clearance of head pond is one of the procedures that the project developer will be taken before head pond being filled in order to secure the operating safety that might be influenced by the trees, waste and etc. to be submerged. The project owner will closely coordinate with Provincial Agriculture and Forestry Office (PAFO) and District Agriculture and Forestry Office (DAFO) to undertake the head pond clearance.

And attribute to the river-type characteristics, the hydrological feature such as the precipitation, temperature and etc. will not alter obviously. Furthermore, the minimum water release will be not less than the natural flow in the dry season to maintain the eco-system.

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

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

Stakeholder comments are collected by questionnaires and interviews.

The participants of the surveys and interviews were from different groups including: all the stakeholders who concerns about the project, representative of Lao Women's Union at village level, Lao national Old People 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	11	22%
	30~40	19	38%
	40~50	13	26%
	Above 50	7	14%
Gender	Male	29	58%
	Female	21	42%
Education	Elementary school	25	50%
	Junior high school	14	28%
	Senior high school	8	16%
	College and above	3	6%

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) 94% of the respondents agree with the construction of the project, 6% of them don't care with the project, and 0% of the respondents disagree with the construction of the project.
2) There are 84% of the respondents consider the implement of the project have positive influence on local economic development, and 16% 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 62% of the respondents consider the implement of the project can improve the live quality of local residents, 38% 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, 14% of the respondents worry about the dust produced during the project construction, 24% of the respondents worry about the effect of noise, 32% of the respondents worry about the soil and water conservation problem, 24% of the respondents worry about the effect of solid wastes, and 6% of the respondents worry about the effect to the ecological environment;
6) 12% of the respondents consider the construction of the project will improve local environment condition, 32% of the respondents consider the construction of the project

have no influence to local environment, 56% 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.

- - - - -

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	Nam Samoy Hydropower Co., Ltd.
Street/P.O. Box	13 North Road, Phonhong District
Building	
City	Vientiane Capital
State/Region	
Postcode	
Country	Lao PDR
Telephone	856-30-9401257
Fax	856-30-5264987
E-mail	
Website	
Contact person	Khamsay Sithiphone
Title	Managing Director
Salutation	Mr.
Last name	Sithiphone
Middle name	
First name	Khamsay
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	Sithiphonesnx.ps@gmail.com

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	Swiss Carbon Assets Limited
Street/P.O. Box	Technoparkstrasse 1
Building	-
City	Zürich
State/Region	-
Postcode	8005
Country	Switzerland
Telephone	+41 43 501 35 50
Fax	+41 43 501 35 99
E-mail	registration@southpolecarbon.com
Website	-
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 50
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 and standardlized baseline

Please refer to the Section B.1 of the PDD.

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

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
	$FC_{i,y}$		$EF_{CO2,m,i,y}$	$NCV_{i,y}$	$FC_{i,y}$ 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.

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

= 1×0.5595

= 0.5595 tCO_2e/MWh.

Based on the equation and above data, the $EF_{grid,OM\text{-}ave,y}$ =0.5595 tCO_2/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*
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 **Error! Reference source not found.**; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-PDD-SSC-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

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project design document, SSC project activities