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

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SECTION A. General description of project activity

A.1 Title of the project activity:

Project title: **Stung Tatay Hydroelectric Project**
PDD Version: 4.0
Completion date PDD: 26/11/2012

A.2. Description of the project activity:

The Stung Tatay Hydroelectric Project (hereafter referred to "the project" or "project") is located at middle downstream of the Tatay River in Koh Kong Province, Cambodia. The catchment of the Tatay River is situated at 300km away from Phnom Penh in the west, the capital of Cambodia and 30km away from Koh Kong City in the northeast, the capital of Koh Kong Province.

The main objective of the project is to generate power from clean renewable hydro power in Koh Kong Province for the contribution to the sustainability of power generation of the Phnom Penh Power Grid.

The scenario prior to the implementation of the project activity is that electricity delivered to the grid is generated by the operation of grid-connected power plants and by the addition of new generation sources of the Phnom Penh Power Grid which is identical with the baseline scenario. Heavy Fuel Oil and diesel fuel power generation is currently the dominant power supply option within the Phnom Penh Power Grid. By displacing Heavy Fuel Oil and diesel fuel power generation with clean and renewable energy, the project leads to the reduction of CO_2 emission into the atmosphere. Total annual GHG emission reduction is estimated to be of 563,074tCO_2e annually.

The project scenario falls within Sectoral Scope 1 - Energy Industries (hydropower generation).
The proposed project comprises of 3 sets of turbine and generators (3×82MW) which amount to a total capacity of 246MW. The expected net annual power supply to the gird is 857,300MWh[1]. The expected operation hour is 3,488hours. The plant load factor (PLF) is 39.82%[2]. The power generated by the proposed project will be routed to 230kV O-Saom Substation via about 65km 230kV line to Phnom Penh power grid. The project is a hydroelectric power project with a new reservoir, whose water surface area is 16,000,000m^2 with a power density of 15.375W/m^2.

Contribution to sustainable development

The project activity's contributions to sustainable development are:

- Reducing the dependence on exhaustible fossil fuels for power generation;

[1] System power loss is about 0.1%: 1-857,300MWh/(246MW*3,488h) ≈ 0.1%

[2] In accordance with EB48 Annex 11 guideline for the reporting and validation of Plant Load Factor, the ex-ante plant load factor is defined according to the data sourced from Feasibility Study Report determined by Northwest Hydro Consulting Engineers which is an authentic third party with a design qualification Class A contracted by the PP. Power load factor=Operation hours/8760=3,488/8,760=39.82%

- Reducing the air pollution by displacing Heavy Fuel Oil power plants with clean, renewable power;
- Reducing the adverse health impacts from the air pollution;
- Reducing the emission of greenhouse gases, to combat the global climate change;
- Contributing to the electricity shortage and the local economic development through the employment creation.

This project fits with the Cambodian government objective to reduce the dependence on exhaustible fossil fuels for power generation, make the energy sector in general and the power sector in particular more sustainable.

A.3. Project participants:

The parties involved in the project are shown in Table A.1:

Table A.1: Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	the Party involved wishes to be considered as project participant (Yes/No)
Cambodia (Host)	Cambodian Tatay Hydropower Limited	No
The Netherlands	Gazprom Marketing & Trading Singapore Pte. Ltd.	No

For more detailed contact information on participants in the project activities, please refer to Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Cambodia

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

Koh Kong Province

A.4.1.3. City/Town/Community etc:

Thmabang District

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The dam site of the proposed project is 1.4m upstream of the junction between Tatay River and its tributary named Stung Kep and 40km away from Koh Kong City, the capital of Koh Kong Province. The geographical coordinates of the main dam is 103°15′44″of East longtitute and 11°37′46″of North latitute[3].

[3] The main dam on the on the main stream of Tatay river and the auxiliary dam on the tributary of the Tatay River form one new reservoir, and the location of the auxiliary dam is closed to the main dam.

The geographical coordinates of the powerhouse is 103°10′11″of East longtitute and 11°35′23″of North latitute. The Figure A.1 shows the location of the project on the map as below:

Figure A.1: Map of the project location:

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

The project activity falls within Sectoral Scope 1: Energy Industries.
- Electricity generation from renewable energy (hydropower generation)

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

The proposed project is a diversion type hydropower station. Two dams are constructed to form a new reservoir. The concrete face rock-fill dam is located on the main stream of Tatay river and the auxiliary dam was located in Stung Kep River which is a tributary of the Tatay River. The three-opening bank spillway is located on the left bank of the Stung Kep River. Headrace power system and the river-side ground powerhouse are located at the left bank of the Tatay River; access roads to dam crest and project site are provided on the left bank. The maximum height of the main dam located on the main stream is 110.0m, and the maximum height of the dam located on the Stung Kep River is 77.0m. A new reservoir is formed with the water surface of 16,000,000m^2 and the power density is 15.375W/m^2. The designed net water head for the power generation is 188m. The power generated by the proposed project will be routed to 230kV O-Saom Substation via about 65km 230kV line to Phnom Penh power grid.

The proposed project plans to equip 1 set of back-up diesel generator at the powerhouse and another 2 sets of diesel generator at the dam sites in case of emergency. The expected annual emissions associated with the operation of the emergency back-up diesel generators amount to about 0.0051% of total emission reductions. The actual emissions resulted from the operation of the diesel generators will be calculated and considered as project emissions once it is more than 1% of emission reduction. Operation hours of the emergency back-up diesel generators will be recorded at the project site. The monitoring meters will be installed at the higher side of on-site transformer station. The installation and calibration will be in accordance with relevant Cambodian regulations.

Table A.3. Technical specifications of the turbine / generator units (specifications are per unit)

Turbines (The specifications of the 3 units are the same)		***Source from Equipment Contracts*[4]**
	Type	HL(ZF220)-LJ-250
	Nominal power	84.6MW
	Nominal efficiency	≥92.47%
	Lifetime	40years
Generators (The specifications of the 3 units are the same)	Type	SF 82-16/5680
	Rated capacity	82MW/96.47MVA
	Nominal efficiency	≥98.01%
	Lifetime	40years

The proposed project will install 3 sets of turbine and generators (3×82MW) which amount to a total capacity of 246MW and a total net electricity supply of 857,300MWh. The project adopts the conventional hydro power technology which will be manufactured by Zhejiang Fuchunjiang Hydropower Equipments Co., Ltd in China. Therefore the project is related to technology transfer. The technology employed has been used in China before and its implementation at the proposed location received approval by the Environment Protection Bureau as further discussed in section D.

In accordance with the applied methodology, the greenhouse gases involved in the project activity consist of CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity.

[4] The equipment contracts have been provided to the auditor for validation.

As a new project, the baseline scenario of the proposed project is the same as the scenario existing prior to the start of the implementation of the above proposed project activity. The spatial boundary of the proposed project involves the project itself and the power plants connected to the Phnom Penh power grid. Detailed information on the installed capacity and annual power generation of Phnom Penh power grid is in Annex 3.

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

A 7-year renewable crediting period (renewable twice) is selected for the proposed project activity. The estimation of the emission reductions in the crediting period is presented in Table A.3.

Table A.4: The estimation of the emission reductions in first crediting period:

Year	**The estimation of annual emission reductions (tCO_2e)**
Year 1: 01/09/2013 –31/08/2014	563,074
Year 2: 01/09/2014 –31/08/2015	563,074
Year 3: 01/09/2015 –31/08/2016	563,074
Year 4: 01/09/2016 –31/08/2017	563,074
Year 5: 01/09/2017 –31/08/2018	563,074
Year 6: 01/09/2018 –31/08/2019	563,074
Year 7: 01/09/2019 –31/08/2020	563,074
Total estimated reductions (tones of CO2e)	**3,941,518**
Total number of crediting years in 1st crediting period	7
Annual average over the 1st crediting period of estimated reductions (tones of CO2e)	563,074

A.4.5. Public funding of the project activity:

There is no public funding from Annex I countries available to the proposed project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

Baseline methodology:
Approved consolidated baseline and monitoring methodology ACM0002 (Version 12.3.0): Consolidated baseline methodology for grid-connected electricity generation from renewable sources (approved on 66th CDM-EB conference on March 2nd , 2012)

This methodology draws upon the following tools:
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 02)
- Tool to calculate the emission factor for an electricity system (Version 02.2.1)
- Tool for the demonstration and assessment of additionality (Version 06.1.0)
- Guidelines on the assessment of investment analysis (Version 05)

For more information on the baseline and monitoring methodology we refer to the UNFCCC website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

The baseline and monitoring methodology ACM0002 is applicable to the proposed project, because the project meets all the applicability criteria stated in the methodology and associated tools:

- The proposed projects involve the installation of a new grid-connected renewable hydropower plant at a site where no renewable power plant was operated prior to the implementation of the project activity.
- The water surface of the new reservoir is 16,000,000m^2 and the power density is 15.375W/m^2. The power density is larger than 4W/m^2, which satisfy the requirement of ACM0002.
- The project does not involve an on-site switch from fossil fuels to a renewable source.
- The Phnom Penh Power Grid which the proposed project will be connected to, can be identified clearly both on the geographic location and the system boundary; as well as the grid character is available public.

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

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.

Emission sources and gases included in the project boundary for the purpose of calculating project emissions and baseline emissions are determined in the methodology, and shown in Table B.1 below.

Table B.1: Inclusion of gases and sources in the calculation of the emission reductions:

	Source	Gas	Included?	Justification / explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity (Phnom Penh Power Grid)	CO_2	Yes	Main emission source
		CH_4	No	Negligible. Minor emission source
		N_2O	No	Negligible. Minor emission source
Project Activity	Emissions of CH4 from the reservoir	CO_2	No	Negligible. Minor emission source
		CH_4	No	Negligible. The power density is 15.375W/m^2. The power density is larger than 10W/m^2, hence, the project emission is negligible.
		N_2O	No	Negligible. Minor emission source

In line with the methodology, the greenhouse gasses accounted for are CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the proposed project activity and CH_4 emissions from the reservoir. The project is a hydroelectric power project with a new reservoir, whose water surface area is 16,000,000m^2 with a power density of 15.375W/m^2. The power density is larger than 10W/m^2, therefore, the project emission can be ignored according to ACM0002.

Methodology ACM0002 refers to the 'Tool to calculate the emission factor for an electricity system' for the definition of an electricity system. According to this tool, the relevant grid definition should be based on the following considerations:

1. Use the delineation of the project electricity system and connected electricity system as provided by the DNA of the host country if available; or
2. Use, where DNA guidance is not available and the electricity system does not have spot markets for electricity or where it is impossible to determine the operational rate of the transmission line, the following definition of boundary:
In large countries with layered dispatch system (e.g. state/provincial/regional/national) the regional grid definition should be used.

In accordance with the grid definition in 'Tool to calculate the emission factor for an electricity system', Phnom Penh Power Grid is defined by Cambodia DNA[5] and whereas selected as the project electricity system, which includes all power plants physically connected to this system. The proposed project activity is connected to the Phnom Penh Power Grid, which is selected as the project electricity system.

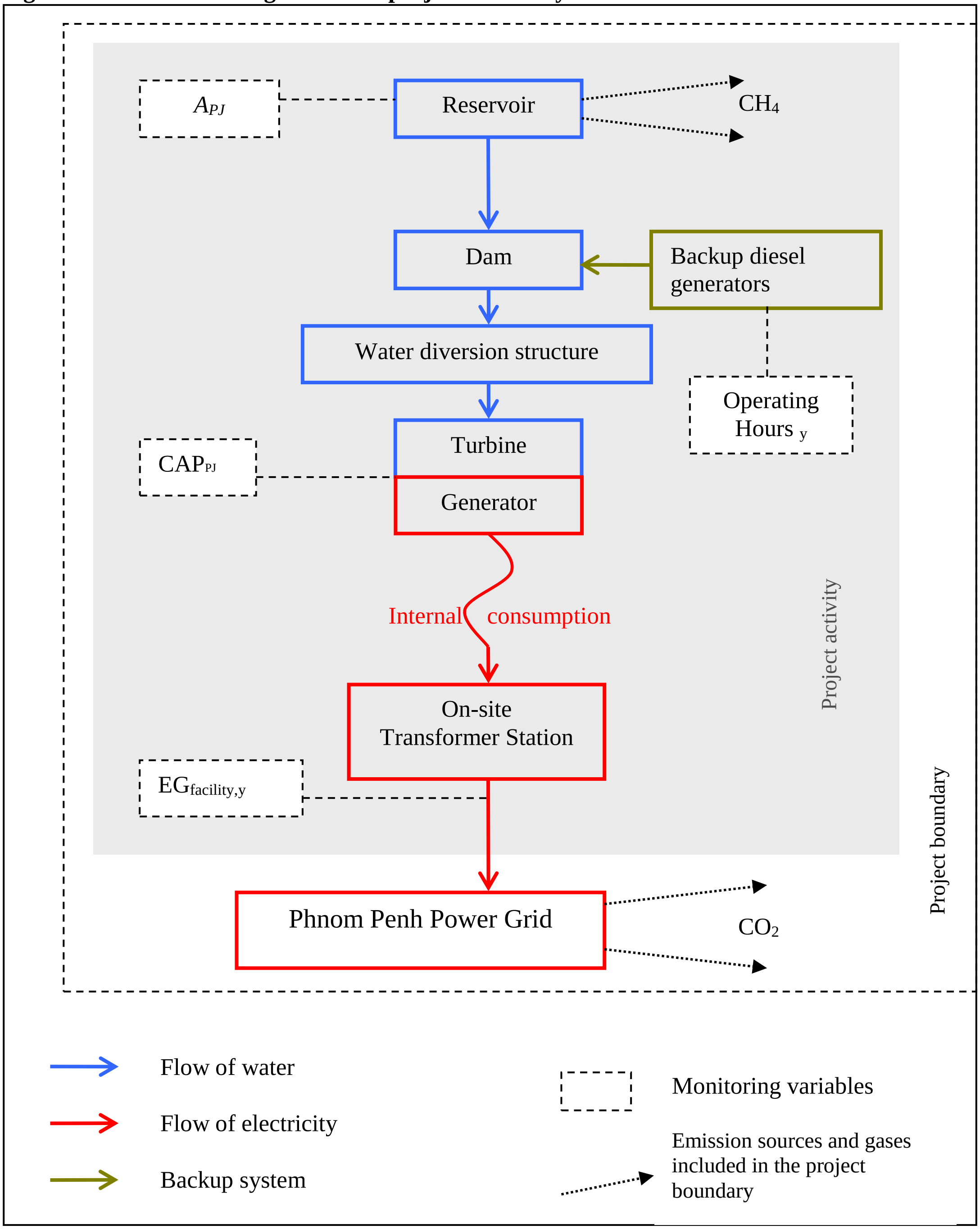
The Electricity Authority of Cambodia (EAC), which is an autonomous body set up to regulate and monitor the electric power sector throughout the country, defines the Phnom Penh Grid System as follows:

"In 2009, The Phnom Penh Grid System was connected to the Vietnam Grid by double circuit 230kV line from Chau Doc in Vietnam to grid substation at Takeo and GS4 in Phnom Penh. By the end of 2009, the sources of power connected to Phnom Penh Grid System are Vietnam system at 230kV, CETIC Hydro station at Kirirom, Khmer Electrical Power Co. Ltd and (Cambodia) Electricity Private Co. Ltd at Phnom

[5] The Phnom Penh Power Grid was defined in "The Grid Emission Factor of the Phnom Penh Electricity Grid" which was published by Cambodia DNA and Institute for Global Environmental Strategies.

Penh at 115kV and Cambodia Utilities Pte Ltd., City Power Group Corporation, Colben Energy (Cambodia) Limited, SL Garment Processing (Cambodia) Ltd at Phnom Penh at 22kV. The Phnom Penh Grid System supplies power to Phnom Penh, parts of Kandal, Kampong Speu and Takeo Provinces". In addition, Électricit é du Cambodge (EDC), comprised of one diesel power plant (C3) and two thermal power plants (C5 and C6) and small three diesel generator plants, supplies Electricity to the Phnom Penh Grid System[6].

Figure B.1: Flow diagram of the project boundary:



[6] According to the data obtained from EDC.

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

The proposed CDM project activity is the installation of a new grid-connected renewable power plant. Therefore, the baseline is identified in the methodology and defined as:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

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

Prior consideration of CDM

Registration of the project as a CDM project would result in additional revenues for the project, significantly improving the economic attractiveness of the project. Additional revenues from the CDM were considered a key factor in the decision by the project developer to invest in the proposed project activity, as detailed in the below timeline Table B.2.

Start of the project activity

In accordance with the Glossary of CDM Terms and subsequent guidance from the EB, the starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. On 22 May 2010, the main dam construction contract was signed. This date is the formal start of the project activity in accordance with the Glossary of CDM Terms and subsequent guidance from the EB as all others dates that could be considered as real action or irreversible commitments from the side of the project entity are at a later stage.

CDM prior consideration

In Dec 2007, the FSR was issued by the qualified design institute, Northwest Hydro Consulting Engineers. The project owner started to consider CDM revenue due to the poor economic return in their meeting based on the FSR, which held in Jun 3th 2008.

Later the business license was issued on 23rd October 2009. The investment license was authorized by the Council for the Development of Cambodia on Dec 7th 2009. Considering that the FSR was completed early and over one year before the project owner made the board meeting decision to invest of the project a Project Financial Evaluation Report[7] was prepared on Jan 2010. Project owner decided to invest the proposed project, with the consideration of CDM revenue due to the low financial return of the proposed project with the financial parameters from the *Project Financial Evaluation Report* and *FSR* on March 3rd 2010. The project participant was aware of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project.

[7] The assessment reflected that the total investment increased slightly. And the other parameters for investment analysis estimated in FSR in Dec 2007 are still suitable as the basis for project owner to make the investment decision.

Following the Guidance on the demonstration and assessment of prior consideration of the CDM (Annex 13, EB 62), "Proposed project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and/or the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. The notification has been proposed within six months of the project activity start date (May 22nd, 2010) in accordance with EB's guidance. The CDM consideration form was sent to Cambodian DNA on 16 September 2010. Notification of the prior consideration of CDM was also reported to UNFCCC was confirmed by CDM EB on 19 November 2010. The above dates indicate that the benefits from CDM were taken into account at an early stage of the project development.

Continuous CDM activities

On 29 June 2011, a term sheet of CDM development was signed between Caspervandertak Consulting and Cambodian Tatay Hydropower Limited. After the commercial negotiation, in November 2011, ERPA was signed between Gazprom Marketing & Trading Singapore Pte. Ltd and project owner. Subsequently, PDD was uploaded for Global Stakeholder Consultation in December 29th 2011. Cambodian LoA was approved on Jan 16th 2012.

The gaps between real and continuing CDM actions were less than two years, hence the continuing and real actions were well taken to secure CDM status for the project in parallel with its implementation.

Table B.2: Timeline of project key events:

Date	Events	Evidence
Sep 2007	The Initial EIA[8] was completed	Initial EIA
Dec 2007	FSR was completed	FSR
Mar 2008	The Initial EIA was approved	Initial EIA approval
Jun 3rd 2008	The Board decided to develop the project as a CDM project due to it is not financially feasible without CDM revenues support.	Board meeting minutes
Oct 23th 2009	The business license was issued.	Business license
Oct 25th 2009	Since the FSR was completed early and over one year before the project owner made the board meeting decision to invest of the project and develop the proposed project as a CDM project, the project owner requested the Northwest Hydro Consulting Engineers to update the investment analysis parameters.	Letter to the Northwest Hydro Consulting Engineers
Dec 7th 2009	The project investment license was authorized to Project Owner	Investment license
Jan 2010	Project financial evaluation report was completed in which the investment analysis parameters were re-evaluated. The project financial evaluation report concludes that the total investment is higher than Feasibility Study Report. And the other parameters for investment analysis estimated in FSR in Dec 2007 are unchanged.	Project Financial Evaluation Report
Mar 3rd 2010	**Board meeting decision**: Project owner decided to invest the proposed project, with the consideration of CDM revenue due to the low financial return of the proposed project with the financial parameters from the *Project Financial Evaluation Report*.	Meeting Minutes
May 22nd 2010	**Project starting date:** The construction contract of main dam was signed	Contract

[8] Both IEIA and EIA were carried out by Key Consultants Cambodia for Development and approved by Cambodian Ministry of Environment eventually. According to the Cambodian environmental impact assessment process, an initial EIA should be approved in Mar 2008 before the project construction in collaboration with other concerned ministries. In comply with the further requirements and advices among all relevant ministries, the EIA report are approved by the Ministry of Environment.

May 26th 2010	The construction contract of auxiliary dam was signed	Contract
May 26th 2010	The construction contract of headrace system was signed	Contract
May 26th 2010	The construction contract of powerhouse was signed	Contract
Jun 7th 2010	Project construction starting was approved	Start order
Jun 12th 2010	The equipment contract was signed	Contract
Jul 2010	EIA was completed	EIA
Sep 16th 2010	Notification of the prior consideration of CDM was reported to Cambodian DNA	CDM consideration Form
Nov 19th 2010	Notification of the prior consideration of CDM was confirmed by CDM EB.	
Jan 17th 2011	EIA approval was issued	EIA approval
Jun 29th 2011	Term sheet of CDM development was signed between Caspervandertak Consulting and Cambodian Tatay Hydropower Limited	Term sheet
Nov 2011	ERPA was signed	ERPA
Dec 29th 2011	PDD was uploaded for GSP	UNFCCC[9]
Jan 16th 2012	Cambodian LoA was approved	Cambodian LoA
Sep 2013	The expected commissioning date of the proposed project	

The additionality of the project activity is demonstrated using the steps described in the 'Tool for the demonstration and assessment of additionality' (version 06.1.0).

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

According to the Validation and Verification Manual (version 01.2) 105: "*The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.*" As the methodology ACM0002 prescribes the baseline scenario for the proposed project, there is no need to further analyze alternatives to the project activity to assess and demonstrate the additionality.

Step 2. Investment analysis

Sub-step 2a: Determine appropriate analysis method

- The analysis will be analyzed through Option III of 'Tool for the demonstration and assessment of additionality (Version 06.1.0)', i.e. benchmark analysis. This method is applicable because:
- Option I: Simple cost analysis, does not apply as the project generates economic returns through the sales of electric power to the grid.
- Option II: Investment comparison analysis is not used as the project entity is not considering to invest in the construction of one of the other identified alternatives.
- Option III: Benchmark analysis, is used as the return on investment relative to the industry benchmark was crucial for the decision to go ahead with the project.

Furthermore, following ***Guidance 19*** in '*Guidance on Assessment of Investment Analysis, version 05*', as the alternative to the proposed project activity is the supply of electricity from a grid this is not to be considered an investment, a benchmark approach is considered appropriate.

Conclusion: Only Option III Benchmark analysis is applicable to the project activity.

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

[9] http://cdm.unfccc.int/Projects/Validation/DB/F97R4TP71A956TR9V98FRMWO2HVY7A/view.html

The project faces a barrier to implementation due to poor returns on investment. To illustrate this, the project developer should identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context. As prescribed by the Additionality Tool, the project developer has chosen project IRR to demonstrate the additionality. The project IRR then is compared to an appropriate benchmark.

Determination of benchmark:

According to *Guidance on Assessment of Investment Analysis, version 05*, "Local lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR". The project IRR and local lending rate offered by commercial banks in Cambodia were chosen by the project entity for comparison. According to the authentic economy statistic of Mundi Index, Cambodian commercial bank prime lending rate is 15.81% in December 2009 and ***15.63%*** in December 2010[10]. Because Project Financial Evaluation Report was completed in Jan 2010 which was the basis of the investment decision, soon afterwards the board meeting decision was made in March 2010, in accordance with conservative rule the lower commercial lending rate of ***15.63%*** is chosen as the benchmark for the project investment analysis.

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

For the calculation of the financial indicators for the proposed hydropower project, we used the parameters listed in Table B.3.the parameters in the financial analysis are demonstrated as below:

Table B.3: Parameters used in the calculation of the pre-tax project IRR:

Parameters	***Amount***	***Unit***	***Source***
Total Static investment[11]	482,460,000	USD	*FSR Page 137*
Working Capital	328,000	USD	*FSR Page 138 and* financial evaluation report
Annual power supply	857,300,000	kW.h	*FSR Page 146 and* financial evaluation report
O&M cost	8,720,000	USD	*FSR Page 144 and* financial evaluation report
Power price	0.0748[12]	USD/kW.h	*FSR Page 139and* financial evaluation report
Residual value rate	0	%	*FSR Page 150 and* financial evaluation report
Operational lifetime[13]	37	Years	*FSR Page 137 and* financial evaluation report
Construction period	5	Years	*FSR Page 137and* financial evaluation report

[10] The Cambodian commercial bank prime lending rate is sourced from the statistic data which are published by the authentic economy statistic of Mundi Index by the end of annual year. Thus, no such data on a monthly basis are available in the economy statistic of Mundi Index. As the investment decision was made in March 2010, the lower Cambodian commercial bank prime lending rate ***15.63%*** between year 2009 and year 2010 were chosen according to the conservative rule.

Source: http://www.indexmundi.com/cambodia/commercial_bank_prime_lending_rate.html

[11] Since the FSR was completed early and over one year before the project owner made the board meeting decision to invest of the project and develop the proposed project as a CDM project, the project owner requested the Northwest Hydro Consulting Engineers to update the investment analysis parameters. Compared to the investment analysis parameters in the FSR, parameters in the Financial Evaluation Report remains unchanged besides the value of investment in the Financial Evaluation Report is higher than that in the FSR. To be conservative, the PDD use the parameters in the FSR to assess the additionality.

[12] There is no VAT included in this power price.

[13] In IRR calculation, the project is expected to be commissioned after 4 years and 8 months' construction. Thus, the operational period is longer than 37 years, which is in accordance with the conservative rule.

According to **Guidance 11 of** *Guidance on Assessment of Investment Analysis, version 05 "* Due to the impact of loan interest on income tax calculations it is recommended that when a project IRR is calculated to demonstrate additionality a pre-tax benchmark be applied." Therefore, **pre-tax** Internal Rate of Return (IRR) is calculated in investment analysis. The pre-tax IRR is compared to the benchmark of 15.63% defined in sub-step 2b.
The main results of the investment analysis are presented in Table B.4, where the IRR for the proposed project has been calculated with and without CDM revenues.

Table B.4: Main results of the IRR calculations:

Scenario	IRR(Pre-Tax)
Project IRR **without** revenues from the sale of CERs	9.59%

From the results in Table B.4, it is clear that the return on investment for the Project without the revenues from the sales of CERs is lower than the 15.63% benchmark that applies to hydropower stations of this scale. This demonstrates that the proposed project activity is not a commercially viable option to supply power. The detailed spreadsheet calculations are available to the validator.

The suitability analysis for input values:

Since the FSR was completed early and over one year before the project owner made the board meeting decision to invest of the project and develop the proposed project as a CDM project, the project owner requested the Northwest Hydro Consulting Engineers to update the investment analysis parameters. Compared to the investment analysis parameters in the FSR, parameters in the Financial Evaluation Report remains unchanged besides the value of investment in the Financial Evaluation Report is higher than that in the FSR. To be conservative, the PDD use the parameters in the FSR to assess the additionality.

Total static investment:
The Feasibility Study Report of the project was designed by Northwest Hydro Consulting Engineers which is authorized the design qualification Class A by Chinese authorities.
Furthermore, the research on hydropower stations[14] in Cambodia has been made in below Table B.5. The ratios of Total investment/Installed Capacity range from 1,583.5USD/kW to 2,125.0USD/kW. The total investment/Installed Capacity of proposed project is 1,961.2USD/kW that falls the range of other hydropower projects. Thus the proposed project's total static investment is reasonable.

Table B.5 Unit static investment cost comparison in Cambodian hydropower stations.

Project Name	Installed Capacity (MW)	Total Investment (USD)	Total Investment per kW(USD/kW)	Source
Kamchay Hydroelectric BOT project	193.2	320,545,000	1,659.1	UNFCCC[15]
Lower Stung Russei Chrum	338	535,210,000	1,583.5	UNFCCC[16]

[14] Only Kamchay project was operational in December 2011, other projects are still under construction at the time of PDD writing.
[15]Sourced from Kamchay PDD
http://cdm.unfccc.int/filestorage/H/O/1/HO13S82G5647BTKJVWUNXFLD0ICEAZ/PDD%20dated%2001.12.2011?t=RFZ8bTA0eW0wfDCe-b8xZk8-rTN8cWkaWkuZ
[16] Sourced from Lower Stung Russei Chrum Hydro-Electric project PDD
http://cdm.unfccc.int/Projects/DB/BVQI1345566732.13/view

Hydro-Electric Project				
400 MW Lower Se San 2 Hydro Power Project	400	816,230,000	2,040.6	"Powering 21st Century Cambodia with Decentralized Generation"[17]
Cambodia Stung Atay Hydropower Project	120	255,000,000	2,125.0	"Powering 21st Century Cambodia with Decentralized Generation"
Stung Tatay Hydroelectric Project	***246***	***482,460,000***	***1,961.2***	***Tatay FSR***

Annual power supply:
In the FSR of the proposed project, annual net power supply is 857,300,000kWh. This value is estimated by the institute which completed the FSR, a qualified third party. The projected power generation is based on the 49 years' statistics of hydrology data (1952-2001) which is the average of a long period and deemed to be stable.

Furthermore, to confirm the suitability of annual power supply and operation hours, the research on the PLFs in Cambodia hydropower stations has been made in below Table B.6. The PLFs range from 0.299 to 0.433. The PLFs of the proposed project is among the range. Thus the proposed PLF is considered reasonable.

Table B.6 PLFs comparison in Cambodian hydropower stations.

Project Name	Installed Capacity(MW)	Power generation (MWh)	PLF	Source
Kamchay Hydroelectric BOT project	193.2	508,200	0.299	UNFCCC[18]
400 MW Lower Se San 2 Hydro Power Project	400	N.A.	N.A.	Hydro dams under construction or approved for development
Cambodia Stung Atay Hydropower Project	120	455,000	0.433	Public information[19]
Lower Stung Russei Chrum Hydro-Electric Project	338	1,198,200	0.404; 0.406 for the upper scheme and 0.403 for the lower scheme	FSR of Lower Stung Russei Chrum Hydro-Electric Project
Stung Tatay Hydroelectric Project	***246***	***858,000***	***0.3982***	***Tatay FSR***

[17] 'Powering 21st Century Cambodia with Decentralized Generation' is written by Grainne Ryder and published by The NGO Forum on Cambodia and Probe International in October 2009.
[18] Sourced from Kamchay PDD http://cdm.unfccc.int/filestorage/H/O/1/HO13S82G5647BTKJVWUNXFLD0ICEAZ/PDD%20dated%2001.12.2011?t=dkd8bTBnaXlkfDAAvxPmYnNuRfvDdmdL_qL7
[19] http://baike.baidu.com/view/4064367.htm

If we recalculate the IRR result with the power generation (858,000,000kWh), is 9.60% still below the 15.63% benchmark.

Annual O&M costs:
The proposed project has been compared to hydropower stations in Cambodia as below Table B.7. As the public information of O&M costs is limit, the proposed project of unit O&M costs per Installed Capacity is compared to Kamchay Hydroelectric project and Lower Stung Russei Chrum Hydro-Electric Project. The unit O&M costs of the proposed project fall the range of the other 2 projects and considered reasonable.

Table B.7 Unit O&M cost comparison in Cambodian hydropower stations.

Project Name	Installed Capacity (MW)	O&M cost (USD)	Annual O&M Cost per MW (USD/MW)	Source
Kamchay Hydroelectric BOT project	193.2	7,647,000	39,580	UNFCCC[20]
Lower Stung Russei Chrum Hydro-Electric Project	338	10,770,968	31,867	FSR of Lower Stung Russei Chrum Hydro-Electric Project
400 MW Lower Se San 2 Hydro Power Project	400	N.A.	N.A	"Powering 21st Century Cambodia with Decentralized Generation "[21]
Cambodia Stung Atay Hydropower Project	120	N.A.	N.A	"Powering 21st Century Cambodia with Decentralized Generation "
Stung Tatay Hydroelectric Project	***246***	***8,720,000***	***35,447***	***Tatay FSR***

Power Price:
The power price of 0.0748USD/kWh in the Table B. 3 is sourced from the FSR. According to actual Power Purchase Agreement (PPA) signed with Cambodian Grid Company in June 2008, the power price in operational period is 0.0745USD/kWh. Therefore, 0.0748 USD/kWh of power price is conservative and applied in the investment analysis. Based on the PPA, the power price will be fixed during the whole operational period.

<u>Sub-step 2d: Sensitivity analysis</u>

As per Paragraph 20 of *Guidance on Assessment of Investment Analysis, version 05*, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude). Following this guidance, a sensitivity analysis has been conducted with variations of the 4 parameters:

- Total static investment
- Power price
- Annual power supply

[20] Sourced from Kamchay PDD published on UNFCCC
[21] The documents has been provided to DOE

- Annual O & M Cost

Though the O&M cost does not constitute more than 20% of total project cost, they are also applied respectively as one of the 4 parameters for reference.
As requested by Paragraph 21 of *Guidance on Assessment of Investment Analysis*, *version 05*, the DOE should assess in detail whether the range of variations is reasonable in the project context. In the sensitivity analysis of the proposed project, variations of ±10% have been considered in the critical assumptions.

Furthermore, the critical point analysis is demonstrated as below:

- *Total Static Investment:*
When the total investment cost decreases by 42.30%, the IRR of the proposed project begins to exceed the benchmark. The proposed project hasn't completed construction at the time of PDD writing. Currently, the available contracts[22] amount to 293,556,153USD, which are already 60.8% of total static investment costs, and the contract values of these already signed contracts are larger than or close to the estimated values of the corresponding items in the FSR. Even calculated with available actual total investment costs, the project IRR can't reach the benchmark. Hence, project IRR has no possibility to reach the benchmark.

- *Annual O&M costs:*
Variations in the annual O&M costs have an insignificant impact on the return of the project. The IRR cannot cross benchmark when the O&M cost is zero, and it is impossible to happen at all.

- *Annual power supply*
Annual power supply is determined by the average annual power generation, which is linked directly to the water flow. In terms of Tatay River, the water flow is mainly influenced by the rains. The projected power generation is based on the 49 years' statistics of hydrology data (1952-2001) which is the average of a long period and deemed to be stable. Therefore, it is not like for the project to get 62.98% increase of average annual power generation to cross the benchmark.

- *Power price:*
When power price increases by 62.98%, the IRR of the proposed project begins to exceed the benchmark. In case of proposed project, the actual power price is 0.745USD[23] and fixed during the whole operational period which is fixed and lowers than the assumed price of 0.748USD in FSR. Thus, it is impossible for the project to get 62.98% increase of power price to cross the benchmark.

The results of the sensitivity analysis for the IRR without CDM revenues are shown in Table B.8. And figure B.2 provides a graphic depiction.

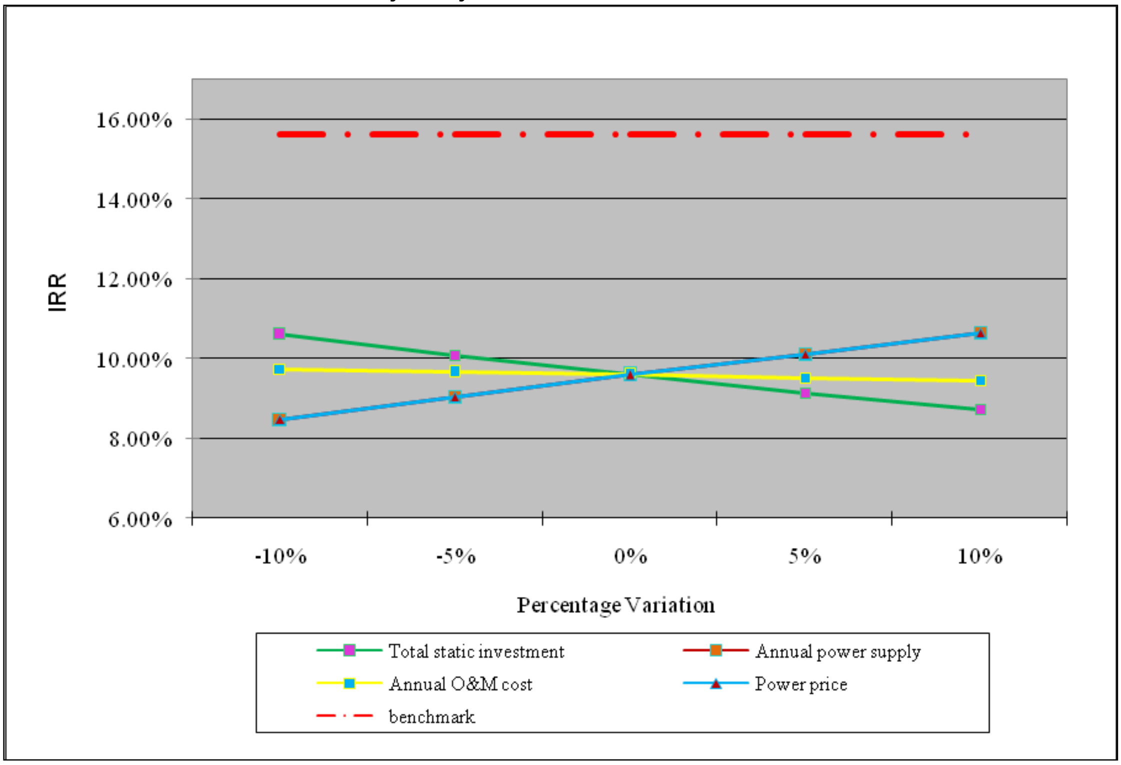
Table B.8: Sensitivity analysis; impact of variations in assumptions on the IRR without CDM revenues:

Percentage Variation / Critical assumption	-10%	-5%	0%	+5%	+10%
Total static investment	10.60%	10.07%	9.59%	9.14%	8.73%
Annual power supply	8.48%	9.04%	9.59%	10.12%	10.64%
Annual O&M cost	9.74%	9.66%	9.59%	9.51%	9.44%
Power price	8.48%	9.04%	9.59%	10.12%	10.64%

[22] The contracts have been submitted for DOE's review.

[23] It can be crosschecked with Power Purchase Agreement

Figure B.2: Results of the sensitivity analysis



The sensitivity analysis of the Internal Rate of Return confirms that the proposed project after realistic modifications to the critical assumptions remains commercially non viable without CDM revenues. The Internal Rate of Return of the proposed project activity without CDM revenues remains below the 15.63% benchmark.

The conclusion may be clear that with reasonable modifications in the critical assumptions, the main results remain unaltered. The results of the sensitivity analysis therefore confirm that the project faces significant economic barriers without CDM revenues.

Step 3. Barrier analysis

The project does not face other barriers besides the low economic returns. Therefore step 3 of the additionality tool is skipped.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:
According to the '*Tool for the demonstration and assessment of additionality*', projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of similar scale, and take place in comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.

In paragraph 6 in the '*Tool for the demonstration and assessment of additionality*', Measures (for emission reduction activities) are defined as a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measures are currently covered in the framework:

(a) Fuel and feedstock switch;
(b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);
(c) Methane destruction;
(d) Methane formation avoidance.

The proposed project is a renewable hydropower energy project which falls in the measure (b) item: Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)

Thus, according to the 'Tool for the demonstration and assessment of additionality', the similar activities to the proposed project activity in measure (b) could be analyzed as below steps:

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

The installed capacity is 246MW, the design capacity range (123MW-369MW) as +/-50% of the proposed project activity is applied in common practice analysis;

Step 2: *In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities shall not be included in this step.*

Cambodia is selected as applicable geographical area. As the starting date of the proposed project is May 22th 2010, so the plants of the capacity from 123MW to 369MW operational before May 22th 2010 are identified. The available published sources (*EAC 2008, 2009 and 2010, EDC 2010*) on hydropower stations, fuel fire power plants and other electricity generation plants in Cambodia by the end of year 2010 are researched and analyzed as below.

Table B.9 Electricity generation plants operational of Cambodia by the end of 2010

Name of generator and power plant	Year commissioned	Installed Capacity, MW
Electricité du Cambodge C3	1995	15.4
C5	1995	13.0
C6	1996	18.6
Cambodia Utilities Pte. Limited	1996	37.1
CETIC International Hydropower Development Co., Ltd	2002	12.0
Khmer Electrical Power Co., Ltd	2005	48.2
City Power Group Corporation	2005	8.1
Colben Energy (CAMBODIA) Ltd	2006	2007:14.8 2008-:21.4
SHC (Cambodia) International Pte Ltd	2006	10.9
(Cambodia) Electricity Private Co, Ltd	2006	48.2
SL Garment Processing (Cambodia) Ltd	2006	4.5
Sovanna Phum Investment Co., Ltd	2008	13.0
Colben Energy (Cambodia) PPSEZ Limited	2008	13.0

Source: EAC 2008, 2009 and 2010, EDC 2010

There are no projects operational with the capacity between 123MW to 369MW.Thus, N_{all} is 0.

Step 4b. Discuss any similar options that are occurring:

According to 'Tool for the demonstration and assessment of additionality', the similar options to Stung Tatay Hydroelectric Project could be analyzed and identified different as below steps:

Step 3, *within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number* N_{diff}.
All projects are identified different. Thus, N_{diff} is 0.

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

$F=1-N_{diff}/N_{all}$ while, $N_{diff}=N_{all}=0$, hence the criteria i.e. F>0.2 and $N_{all}-N_{diff}$ >3 as identified by the guideline cannot be met in case of the proposed project. The proposed project activity is not a common practice within the electricity generation sector in the applicable geographical area.

Therefore the proposed project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions
In accordance with the 'ACM0002 methodology' (Version 12.3.0), baseline emissions for the year *y* are calculated as:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \qquad \text{(B.1)}$$

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);
- $EF_{grid,CM,y}$ is the 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).

Calculation of $EG_{PJ,y}$
As the Project involves the construction of a new grid-connected renewable hydropower station at a site where no renewable power plant was operated prior to the implementation of the project activity:

$$EG_{PJ,y} = EG_{facility,y} \qquad \text{(B.2)}$$

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

For the calculation of Combined Margin (CM) CO_2 emission factor, $EF_{grid,CM,y}$, the methodology refers to the '*Tool to calculate the emission factor for an electricity system*' (Version 02.2.1). In accordance with this tool, the baseline emission factor is calculated as a combined margin: a weighted average of the operating margin emission (OM) factor and the build margin (BM) emission factor. Both the OM and BM emission factors are calculated *ex ante* and will not be updated during the first crediting period.

This PDD refers to the Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor published by the Cambodian DNA in March 2011. We will refer to these emission factors as the 'published emission factors'.

For more information on the published OM and BM emission factors, please refer to:
http://www.camclimate.org.kh/index.php?page=documentation&mcat=cat47&scat=cat51&lang=en

The description below focuses on the key elements in the calculation of the published emission factors and the subsequent calculation of emission reductions. The full process of the calculation of the emission factors and all underlying data are presented in English in Annex 3 to this PDD.

Current Status of Electricity Generation in the Phnom Penh Grid System
The Electricity Authority of Cambodia (EAC), which is an autonomous body set up to regulate and monitor the electric power sector throughout the country, defines the Phnom Penh Grid System as follows: "In 2009, The Phnom Penh Grid System was connected to the Vietnam Grid by double circuit 230kV line from Chau Doc in Vietnam to grid substation at Takeo and GS4 in Phnom Penh. By the end of 2009, the sources of power connected to Phnom Penh Grid System are Vietnam system at 230kV, CETIC Hydro station at Kirirom, Khmer Electrical Power Co. Ltd and (Cambodia) Electricity Private Co. Ltd at Phnom Penh at 115kV and Cambodia Utilities Pte Ltd., City Power Group Corporation, Colben Energy (Cambodia) Limited, SL Garment Processing (Cambodia) Ltd at Phnom Penh at 22kV. The Phnom Penh Grid System supplies power to Phnom Penh, parts of Kandal, Kampong Speu and Takeo Provinces". (Page 45, EAC 2010).

In addition, Électricité du Cambodge (EDC), comprised of one diesel power plant (C3) and two thermal power plants (C5 and C6) and small three diesel generator plants, supplies electricity to the Phnom Penh Grid System.

Table B 10: Electrical output from each power plant connected to the Phnom Penh Grid System

Name of generator and power plant	Year commissioned	Installed Capacity, MW	Energy Sent Out(MWh)		
			2007	2008	2009
Electricité du Cambodge C3	1995	15.4	21,770	43,410	22,610
C5	1995	13.0	20,130	24,440	19,840
C6	1996	18.6	51,820	75,990	43,700
Cambodia Utilities Pte. Limited	1996	37.1	258,490	258,713	182,224
CETIC International Hydropower Development Co., Ltd	2002	12.0	46,498	43,292	44,380
Khmer Electrical Power Co., Ltd	2005	48.2	277,991	317,848	256,247
City Power Group Corporation	2005	8.1	38,238	41,816	34,113
Colben Energy (CAMBODIA) Ltd	2006	2007:14.8 2008:21.4	54,019	45,696	53,235
SHC (Cambodia) International Pte Ltd	2006	10.9	14,700	34,501	17,307
(Cambodia) Electricity Private Co, Ltd	2006	48.2	315,550	325,883	269,480

SL Garment Processing (Cambodia) Ltd	2006	4.5	5,134	4,406	5,758
Sovanna Phum Investment Co., Ltd	2008	13.0	-	23,359	28,033
Colben Energy (Cambodia) PPSEZ Limited	2008	13.0	-	35,658	45,061
Imported from Vietnam	*	100.0	-	-	374,166
Electricity Tramkhnar	2004*		-	-	537
Mr. Bun Huy	2007*		-	-	8
Mr. Toeng Samouv	2007*		-	-	176

Source: EAC 2008, 2009 and 2010, EDC 2010
**Generators started supply of electricity to the Phnom Penh Grid in 2009.*

Table B 11: Fuel consumption of each fossil power plant connected to the grid (ton/year)

Name of generator and power plant	Fuel type	Fuel consumption, ton		
Electricit é du Cambodge		2007	2008	2009
C3	DO	4,950	9,684	4,988
C5	HFO	4,423	5,079	4,543
C6	HFO	12,042	17,085	10,267
Cambodia Utilities Pte. Limited	HFO	61,053	60,794	43,169
Khmer Electrical Power Co., Ltd	HFO	63,186	72,117	57,313
City Power Group Corporation	HFO	8,904	9,773	8,124
Colben Energy (Cambodia) Ltd	HFO	14,097	12,362	13,851
SHC (Cambodia) International Pte Ltd	DO	3,675	8,625	4,324
(Cambodia) Electricity Private Co, Ltd	HFO	72,522	74,840	62,337
Sovanna Phum Investment Co., Ltd	Coal	-	27,727	35,041
Colben Energy (Cambodia) PPSEZ Limited	HFO	-	8,915	11,567

Source: EDC 2010

Description of the calculation process

The key methodological steps according to the '*Tool to calculate the emission factor for an electricity system*' are:
1. Identify the relevant electricity power systems;
2. Choose whether to include off-grid power plants in the project electricity system (optional).
3. Select a method to determine operating margin (OM);
4. Calculate the operating margin emission factor according to the selected method;
5. Calculate the build margin (BM) emission factor, and;
6. Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electricity power systems

According to the '*Tool to calculate the emission factor for an electricity system*', step 1 involves the identification of the relevant electric power system which is described in Section B.3 of this PDD. The project is connected to the Phnom Penh Power Grid through the local transformer station.
In accordance with the tool, the Phnom Penh Power Grid has been selected as the relevant electric power system. There were net electricity imports from Vietnam in 2009 and the emission factor is 0tCO_2e/MWh for conservativeness.

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

Two options are provided in the '*Tool to calculate the emission factor for an electricity system*' (Version 02.2.1) 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)

The '*Tool to calculate the emission factor for an electricity system*' offers several options for the calculation of the OM emission factor:

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

Among them, (b) Dispatch data analysis OM, cannot be used, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, the Simple Adjusted OM methodology cannot be used. The average OM does not take into account the non-dispatchable nature of low-cost/must-run resources and as low-cost/must-run resources constitute less than 50% of total grid generation (see Table B.12), we have selected the Simple OM method as the most appropriate method.

Table B.12: Electrical output from low-cost/must-run sources in the Phnom Penh Grid System

Name of generator and power plant	Fuel type	Energy Sent Out / Input(MWh)				
		2005	2006	2007	2008	2009
CETIC International Hydropower Development Co., Ltd	Hydro power	40,854	47,653	46,498	43,292	44,380
SL Garment Processing (Cambodia) Ltd	Wood	0	1,669	5,134	4,406	5,758
Total grid generation		752,542	911,188	1,105,548	1,270,024	1,021,075
Low-cost/must-run resources share		5.43%	5.41%	4.67%	3.76%	4.91%
Low-cost/must-run resources share		< 50%				

Source: EAC 2010, 2009, 2008, 2007 and 2006.

Data vintage selection

In accordance with the '*Tool to calculate the emission factor for an electricity system*', the OM is calculated according to the '*ex ante option*' and the emission factor is determined once at validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required: For grid power plants, use a three-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without the 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

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

- Data required for option A (based on the net electricity generation and a CO_2 emission factor of each power unit), such as electricity generation, CO_2 emission factor for specific power plants/units serving the grid is not available to the public or to the project participants.
- According to the Cambodian publicly available data, renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known. And
- Off-grid power plants are not included in the calculation (i.e., Option I has been chosen in Step 2).

Option A is available and chosen.

Option A - Calculation based on average efficiency and electricity generation of each plant
Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \text{(B.3)}$$

Where:
$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year *y* (tCO2 /MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2 /MWh)
m = All power units serving the grid in year *y* except low-cost / must-run power
y = The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$
The emission factor of each power unit m should be determined as follows:
Option A1. If for a power unit m data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \bullet NCV_{i,y} EF_{CO2,i,y}}{EG_{m,y}}$$

where:
$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (tCO2 /MWh)
$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2 /GJ)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
m = All power units serving the grid in year y except low-cost/must-run power units
i = All fossil fuel types combusted in power unit m in year y
y = The relevant year as per the data vintage chosen in Step 3

Option A2. If for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,i,y} \times 3.6}{\eta_{m,y}}$$

where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO2 /MWh)

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fuel type i used in power unit m in year y(tCO2 /GJ)

η m,y = Average net energy conversion efficiency of power unit m in year y (ratio)

m = All power units serving the grid in year y except low-cost/must-run power units

y = The relevant year as per the data vintage chosen in Step 3

Option A3. If for a power unit m only data on electricity generation is not available, an emission factor of 0 tCO2/MWh can be assumed as a simple and conservative approach.

Table 13: Calculation of the operating margin

Plant	2007		2008		2009	
	Electricity generated	CO_2 emission factor	Electricity generated	CO_2 emission factor	Electricity generated	CO_2 emission factor
	MWh	tCO_2/MWh	MWh	tCO_2/MWh	MWh	tCO_2/MW
Electricit édu Cambodge						
C3	21,770	0.6834	43,410	0.6705	22,610	0.6631
C5	20,130	0.6602	24,440	0.6245	19,840	0.6881
C6	51,820	0.6983	75,990	0.6756	43,700	0.706
Cambodia Utilities Pte. Limited	258,490	0.7097	258,713	0.7061	182,224	0.7119
Khmer Electrical Power Co., Ltd	277,991	0.683	317,848	0.6818	256,247	0.6721
City Power Group Corporation	38,238	0.6997	41,816	0.7023	34,113	0.7156
Colben Energy (CAMBODIA) Ltd	54,019	0.7842	45,696	0.8129	53,235	0.7818
SHC (Cambodia) International Pte Ltd	14,700	0.7514	34,501	0.7514	17,307	0.7509
(Cambodia) Electricity Private Co, Ltd	315,550	0.6906	325,883	0.6901	269,480	0.6951
Sovanna Phum Investment Co., Ltd			23,359	0.5934	28,033	0.6249
Colben Energy (Cambodia) PPSEZ Limited			35,658	0.7513	45,061	0.7713
Imported from Vietnam					374,166	0
Electricity Tramkhnar					537	0.6702
Mr. Bun Huy					8	0.6702
Mr. Toeng Samouv					176	0.6702

Annual Electricity generation in total	1,052,708		1,227,315		1,346,739	
Simple operating margin CO2 emission factor (tCO_2 /MWh)	0.6989		0.6951		0.5053	
Weight Average **OM (tCO_2 /MWh)**	**0.6257**					

On the basis of these data, the Operating Margin emission factors for 2007, 2008 and 2009 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we refer to the publications cited above and the detailed explanations and demonstration of the calculation of the OM emission factor provided in Annex 3. It is calculated the Operation Margin Emission Factor as **0.6257**tCO_2e/MWh.

The calculation of the OM emission factor is done once (*ex ante*) and will *not* be updated during the first crediting period. This has the added advantage of simplifying monitoring and verification of emission reductions.

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

Data vintage selection

In accordance with the '*Tool to calculate the emission factor for an electricity system*', the BM is calculated according to option one: For the first crediting period, the build margin emission factor is calculated ex-ante based on the most recent information available. For the second crediting period, the build margin emission factor will be updated based on most recent data available at the time of submission of the request for registration. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used.

Determination of Sample Group of Power Units:

According to the 'Tool to calculate the emission factor for an electricity system', capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);
b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG total, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh).
c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SET sample);

   Identify the date when the power units in SET sample started to supply electricity to the grid. If none of the power units in SET sample started to supply electricity to the grid more than

10 years ago, then use SET sample to calculate the build margin. Ignore steps (d), (e) and (f).

Otherwise:

d) Exclude from SET sample the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set (SET sample-CDM) the annual electricity generation (AEGSET-sample-CDM, in MWh); If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. AEGSET-sample-CDM $\geq 0.2 \times$ AEGtotal), then use the sample group SET sample-CDM to calculate the build margin. In this case, ignore steps (e) and (f).

Otherwise:

e) Include in the sample group SET sample-CDM the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

f) The sample group of power units m used to calculate the build margin is the resulting set (SET sample-CDM->10yrs).

The sample *m*, according to the above method, is defined as below:

1) The recent five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) are identified as below table and determine their annual electricity generation (AEGSET-5-units, in MWh) is 79,037MWh.

Table 14: The identified recent five power units and annual electricity generation

Power Plant	Year of operation	Electricity Generated, MWh
Colben Energy (Cambodia) PPSEZ Limited	2008	45,061
Sovanna Phum Investment Co., Ltd	2008	28,033
Mr. Toeng Samouv	2007	176
Mr. Bun Huy	2007	8
SL Garment Processing (Cambodia) Ltd	2006	5,758
Total		79,037MWh

2) The set of power units identified excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit.

Because the total power generation was 1,346,739MWh in 2009, the 20% of AEGtotal is 269,348MWh. Therefore, the power units are identified as below:

Table 15: The identified power units started to supply electricity to the grid most recently and that comprise 20% of AEG_{total}

Power Plant	Year of operation	Electricity Generated, MWh
Colben Energy (Cambodia) PPSEZ Limited	2008	45,061
Sovanna Phum Investment Co., Ltd	2008	28,033
Mr. Toeng Samouv	2007	176
Mr. Bun Huy	2007	8
SL Garment Processing (Cambodia) Ltd	2006	5,758
(Cambodia) Electricity Private Co, Ltd	2006	269,480
Total		348,517

3) From SET5-units and SET≥20% units, SET≥20% of power units that comprises the larger annual electricity generation (SET sample). Therefore the power units in Table 11 are selected as SET sample m.

The Build Margin Emission Factor is, according to the '*Tool to calculate the emission factor for an electricity system*', calculated as the generation-weighted average emission factor (measured in tCO_2/MWh) of all power units *m* during the most recent year *y* for which data is available:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \text{(B.4)}$$

Where:

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

Table 16: The identified power units to calculate BM

Power Plant	Year of operation	Fuel Type	Electricity Generated (MWh)	CO2 Emission Factor (tCO2/MWh)
Colben Energy (Cambodia) PPSEZ Limited	2008	HFO	45,061	0.7713
Sovanna Phum Investment Co., Ltd	2008	Coal	28,033	0.6249
Mr. Toeng Samouv	2007	DO	176	0.6702
Mr. Bun Huy	2007	DO	8	0.6702
SL Garment Processing (Cambodia) Ltd	2006	Wood	5,758	0
(Cambodia) Electricity Private Co, Ltd	2006	HFO	269,480	0.6951
Total			348,517	
BM (tCO2 /MWh)				**0.6878**

Subsequent calculation of the Build Margin emission factor yields a baseline emission factor of **0.6878** tCO_2e/MWh.
The calculation of the BM emission factor for the first crediting period is done once (*ex ante*) and will *not* be updated during the first crediting period. This has the advantage of simplifying monitoring and verification of emission reductions.

Step 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:

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

The weighted average CM method (option A) should be used as the preferred option. The simplified CM method (option b) can only be used if:
• The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered projects at the starting date of validation; and
• The data requirements for the application of step 5 above cannot be met.

Cambodia is a Least Development Country and there are less than 10 registered projects at the starting date of validation. But the data requirements for the application of step 5 above can be met and option A is preferred for CM calculation. Therefore, weighted average CM is selected for CM calculation

(a) Weighted average CM

The Baseline Emission Factor is calculated as a Combined Margin, using a weighted average of the Operating Margin and Build Margin.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot W_{om} + EF_{grid,BM,y} \cdot W_{BM} \qquad \text{(B.5)}$$

Where:

- $EF_{grid,OM,y}$ = The operating margin CO_2 emission factor in year y (tCO_2/MWh);
- $EF_{grid,BM,y}$ = The build margin CO_2 emission factor in year y (tCO_2/MWh);
- W_{OM} = The weighting of operating margin emissions factor (%)
- W_{BM} = The Weighting of build margin emissions factor (%)

The "*Tool to calculate the emission factor for an electricity system*" (Version 2.2.1) provides the following default weights for the first credit period: Operating Margin, W_{OM} = 0.5; Build Margin, W_{BM} = 0.5

We apply published data of 0.6257 for the Operating Margin Emission Factor and 0.6878 for the Build Margin Emission Factor in the first crediting period. Applying the default weights and the published emission factors, a combined margin Baseline Emission Factor of **0.6568**tCO_2/MWh is calculated.

The published emission factor in the calculation of baseline emissions is applied.

Calculation of Baseline Emissions

Baseline Emissions are calculated by multiplying the Baseline Emission factor by the net quantity of electricity supplied to the grid electricity system by the project according to formula B.2 repeated below for convenience:

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

The estimated baseline emissions (see Section B.6.3) are based on expected net power supply to the gird and an *ex ante* calculation of the emission factor in the first crediting period, and will hence be revised during the implementation of the project activity on the basis of actual net power supply to the grid.

Calculation of Project Emissions (PE_y)

Project emissions are calculated by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \text{(B.6)}$$

Where:

- PE_y = Project emissions in year *y* (tCO_2e)
- $PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2)
- $PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e)
- $PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year *y* (tCO_2e)

The proposed project is a hydropower station so $PE_{GP,y} = 0$.

Emissions by the diesel generators associated with the start-up for annual re-commissioning and maintenance requirements can be calculated as follows: The diesel generator will have a total capacity of at most 400kW. The project will install 3 sets of diesel generators with total maximum capacity of 1200kW, which will be maintained for emergency purpose in case the power lines which send the power from the grid are cut off. In case of emergencies the project will not claim emission reductions and the use of the diesel generator will be monitored. The project owners will run the diesel generators about 10 hours[24] annually. So the expected annual power generation can be calculated to be 12,000kWh. Once the emissions of the diesel generator are less than 1% of total emission reductions and are considered negligible according to the Clean Development Mechanism Validation and Verification Manual (VVM) version 01.2[25]. For the emission factor of the diesel generators we refer to the AMS-I.F (version 01) methodology which provides emission factors for diesel generator systems. We apply the highest value listed in the methodology which is 2.4kgCO_2e/kWh (generator below 15kW), which is conservative considering the size of the generator used on-site. The annual emissions by the diesel generators is estimated as 28.8tCO_2e, which would reduce annual emission reductions about 0.0051% and can therefore be considered negligible. Therefore, $PE_{FF,y}$=0.

[24] For the conservative consideration and according to the project owner's experience, project owner assumed that the annual operation hours of diesel generator for emergency is around 10 hours as mentioned above. The operation hours of the diesel generator is just an estimated value, while the value used for calculating the actual emission reduction will come from the monitoring result.

[25] VVM version 01.2 para 77

$$PE_y = PE_{HP,y} \qquad (B.7)$$

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

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 CH_4 and CO_2 emissions from the reservoir, estimated as follows:

The power density of the project activity (*PD*) is calculated as

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

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

In accordance with the methodology, project emissions from the reservoir have to be taken into account in case the power density of the project is between 4 and 10 W/m^2.

$$PE_{HP,y} = \frac{EF_{Res} \bullet TEG_y}{1000}$$

Where:

$PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year y (tCO2e)

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year y (kgCO2e/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)

In accordance with the methodology, project emissions from the reservoir have to be taken into account in case the power density of the project is between 4 and 10 W/m^2. *For the proposed project,* the power density is 15.375W W/m^2, therefore, $PE_{HP,y}$=0.

Consequently, $\mathbf{PE_y = 0}$

Calculation of Leakage (LE_y)

In accordance with the methodology ACM0002 (Version 12.3.0), leakage arise from the fuel disposal, land flooding and others for the construction of the hydropower station will be ignored. Also, the project participates don't advocate emission reductions that reduced under the baseline.

Therefore, $\mathbf{LE_y= 0}$

<u>Calculation of the Project Emission Reductions</u>

Emission reductions are calculated in accordance with methodology ACM0002 (Version 12.3.0) as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (B.8)$$

Where:

- ER_y = Emission reductions in year *y* (tCO_2);
- BE_y = Baseline emissions in year *y* (tCO_2);
- PE_y = Project emissions in year *y* (tCO_2), and;
- LE_y = Leakage emissions in year *y* (tCO_2).

According to the above description, we may simplify the calculation as:

$$ER_y = BE_y \quad (B.9)$$

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

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2e/MWh
Description:	Combined Margin Grid Emission Factor for the project electricity system in year *y*
Source of data:	Calculated ex-ante based on the OM emission factor and BM emissions factor.
Value applied:	**0.6568tCO_2e/MWh**
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from the published emissions factors.
Any comment:	-

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build Margin Grid Emission Factor for the project electricity system in year *y*
Source of data:	Calculated ex-ante (see Annex 3)
Value applied:	**0.6878tCO_2e/MWh**
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated ex-ante (see Annex 3).
Any comment:	-

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2e/MWh
Description:	Operating Margin Grid Emission Factor for the project electricity

	system in year *y*
Source of data:	Calculated ex-ante (see Annex 3)
Value applied:	**0.6257 tCO_2e/MWh**
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated ex-ante (see Annex 3).
Any comment:	-

Data / Parameter:	**Cap_{BL}**
Data unit:	W
Description:	Installed capacity of the hydropower plant before the implementation of the project activity. For new hydropower plants the value is zero.
Source of data:	Methodology ACM0002 Version 12.3.0
Value applied:	**Zero**
Justification of the choice of data or description of measurement methods and procedures actually applied:	The proposed CDM project activity involves a new hydropower station and hence Cap_{BL} is zero.
Any comment:	-

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh
Description:	(Net) Electricity supplied by the project to the grid
Source of data used:	Feasibility Study Report
Value applied:	**857,300 MWh**
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is the best data available
Any comment:	-

Data / Parameter:	**A_{BL}**
Data unit:	m^2
Description:	Area of the single or multiple reservoirs 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
Source of data used:	Feasibility Study Report
Value applied:	$0m^2$
Justification of the choice of data or description of measurement methods and procedures actually applied:	The proposed project built a new reservoir, so this value is zero
Any comment:	-

Parameters used for the calculation of the Operating Margin (OM) and Build Margin (BM) Emission Factors in accordance with the '*Tool to calculate the emission factor for an electricity system*':

Data / Parameter:	**EG_y**
Data unit:	MWh (per annum)
Description:	Net electricity generated and delivered to the grid by power plant in year *y*
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from *EAC 2010, 2009 and 2008, EDC 2010*
Value applied:	For detailed values; see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Cambodian authorities. For the calculation of the OM emission factor, electricity supply per power plant/unit has been used. For the calculation of the BM emission factor, the 5 recent power plant have been applied. For values and a detailed description of the calculation method see Annex 3 and Section B.6.1 respectively.
Any comment:	-

Data / Parameter:	**$FC_{i,y}$**
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plants in year *y*
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from *EDC 2010*
Value applied:	For detailed values; see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Cambodian authorities. For the calculation of the OM emission factor, fuel consumption per power plant/unit have been applied. For the calculation of the BM emission factor, the 5 recent power plants have been used. For values and a detailed description of the calculation method see Annex 3 and Section B.6.1 respectively.
Any comment:	-

Data / Parameter:	**Capacity by power generation source**
Data unit:	MW
Description:	For the different power generation sources, installed capacity in the Phnom Penh Power Grid.
Source of data used:	See the downloadable files mentioned above for the full data set.
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Cambodian authorities.
Any comment:	

Data / Parameter:	**$EF_{co2,i,y}$ and $EF_{co2,m,i,y}$**
Data unit:	tCO_2/GJ
Description:	tCO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	Data used are IPCC default values. See 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Energy

Value applied:	For detailed values; see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the most recent data available, and have been used by the Cambodian authorities to calculate the emission factors.
Any comment:	

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	GJ / mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are Cambodian authorities
Value applied:	For detailed values; see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Cambodian authorities.
Any comment:	

Data / Parameter:	**Fuel CO_2 Emission Coefficients**
Data unit:	$kgCO_2/TJ$
Description:	Carbon dioxide emission factors
Source of data used:	In accordance with Cambodian DNA, the lower limit of 95% confidence interval is applied for CO_2 emission factor calculation to reflect the uncertainty.
Value applied:	For detailed values see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These are the most recent data.
Any comment:	

Data / Parameter:	**Electricity imports from connected grids**
Data unit:	MWh (per annum)
Description:	Electricity imports of power from other grids
Source of data used:	The Electricity Authority of Cambodia 2009
Value applied:	For detailed values; see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Cambodian authorities.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions

The annual net power supply to the Phnom Penh Power Grid during the first crediting period is estimated to be 857,300MWh. Applying formulas presented in Section B.6.1, we obtain the values for the baseline emissions during the first crediting period provided in Table B.17:

Table B.17: The estimation of baseline emissions during the 1st crediting period:

Year	Period	Annual net power supply to the grid (EGy) (MWh)	Baseline emission factor (tCO_2/MWh)	Baseline emissions (tCO_2e)
1	01/09/2013 –31/08/2014	857,300	0.6568	563,074
2	01/09/2014 –31/08/2015	857,300	0.6568	563,074
3	01/09/2015 –31/08/2016	857,300	0.6568	563,074
4	01/09/2016 –31/08/2017	857,300	0.6568	563,074
5	01/09/2017 –31/08/2018	857,300	0.6568	563,074
6	01/09/2018 –31/08/2019	857,300	0.6568	563,074
7	01/09/2019 –31/08/2020	857,300	0.6568	563,074
Total				**3,941,518**
Average				563,074

In a given year, the emission reductions realized by the project activity (ER_y) is equal to baseline GHG emissions (BE_y) minus project direct emissions and leakages during the same year:

$$ER_y = BE_y - PE_y - LE_y$$
$$= 563{,}074 tCO_2 - 0 - 0$$
$$= 563{,}074 tCO_2$$

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

Table B.18: *Ex ante* estimation of emission reductions due to the project:

Year	Project Emissions (tCO2)	Baseline emissions (tCO2)	Leakage (tCO2)	Emission Reductions (tCO2)
Year 1: 01/09/2013 –31/08/2014	0	563,074	0	563,074
Year 2: 01/09/2014 –31/08/2015	0	563,074	0	563,074
Year 3: 01/09/2015 –31/08/2016	0	563,074	0	563,074
Year 4: 01/09/2016 –31/08/2017	0	563,074	0	563,074
Year 5: 01/09/2017 –31/08/2018	0	563,074	0	563,074
Year 6: 01/09/2018 –31/08/2019	0	563,074	0	563,074
Year 7: 01/09/2019 –31/08/2020	0	563,074	0	563,074
Total	**0**	**3,941,518**	**0**	**3,941,518**
Average	0	563,074	0	563,074

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh
Description:	Electricity supplied to the grid by the project (net)
Source of data to be used:	Project activity site
Value of data applied for the purpose of	857,300

calculating expected emission reductions in section B.5 :	
Description of measurement methods and procedures to be applied:	The net electricity supplied to the grid by the project is monitored by measurement result of electricity supplied to the grid minus electricity delivered from the grid to the project. For details we refer to section B.7.2, electricity supplied to the grid and electricity delivered from the grid to the project are continuously mesured by project entity with national standard electricity metering instruments M1, M2 and M3 (see Figure B.3). The measurement will be conducted technically in accordance with national regulations. Monitoring frequency is continuous measurement and monthly recording.
QA/QC procedures to be applied:	These data will be directly used for measurement of emission reductions. Measurement results of electricity supplied to the grid and that delivered from the grid to the project will be cross-checked against Electricity Transaction Notes (hereinafter ETNs). In case of discrepancies the conservative value will prevail. The metering instruments will be calibrated annually.
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after implementation of the project activity.
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5 :	246
Description of measurement methods and procedures to be applied:	Installed capacity of the project activity will be determined according to installed equipments' nameplates and will be monitored annually. The nameplate will be checked by DOE during verification. Monitoring frequency is yearly.
QA/QC procedures to be applied:	No further QA/QC procedures are considered necessary.
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Measured at the project site
Value of data applied for the purpose of calculating expected emission reductions in	16,000,000

section B.5 :	
Description of measurement methods and procedures to be applied:	The surface area will be calculated using the design schematics and area maps. Photographs of the reservoir at several key locations will be taken when the project becomes operational to check whether the actual reservoir does not deviate substantially for the design. Monitoring frequency is yearly.
QA/QC procedures to be applied:	The power density of the project is well above 10 W/m^2 and therefore substantial deviations from the calculated design flooded surface area will not affect the calculation of emission reductions by the project. Therefore no further QA/QC procedures will be applied.
Any comment:	-

Data / Parameter:	**Operational hours of emergency back-up diesel generator**
Data unit:	Hours /year
Description:	Annual hours that all back-up diesel generators is running either for the purpose of commissioning/maintenance or actual emergencies
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5 :	10
Description of measurement methods and procedures to be applied:	The project entity will record the operational hours in the daily operation logs. Monitoring frequency is simultaneous measurement and recording along with operation.
QA/QC procedures to be applied:	The expected annual emissions associated with the operation of the emergency back-up diesel generators amount to about 0.0051% of total emission reductions. The actual emissions resulted from the operation of the diesel generators will be calculated and considered as project emissions once it is more than 1% of emission reduction and therefore deducted from baseline emissions. Further QA/QC procedures are therefore not considered necessary.
Any comment:	-

B.7.2 Description of the monitoring plan:

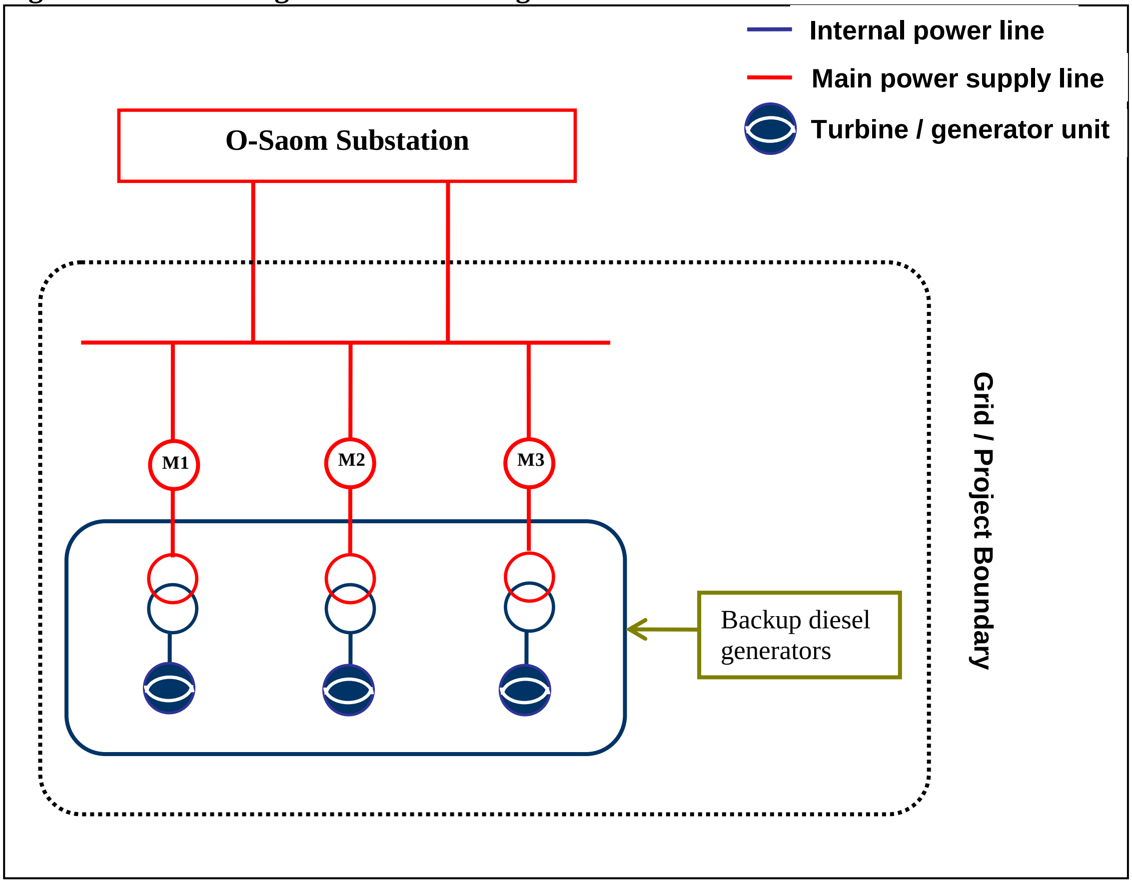
This monitoring plan outlines the principles which shall be followed in the monitoring of the parameters listed in section B.7.1. A monitoring manual with detailed procedures will be prepared on the basis of the principles outlined below. The monitoring manual may be updated to reflect the actual implementation of the project but will not deviate from the monitoring plan as presented in this section.

Monitoring of net electricity supplied by the project to the grid

The power generated by the proposed project will be routed to 230kV O-Saom Substation via 2 main power lines to Phnom Penh power grid. An indicative grid connection diagram is provided in Figure B.3.

The grid connection diagram indicates the principles for positioning of metering instruments that will be used in the monitoring of emission reductions. The project entity will ensure that the actual implementation of grid connection will not deviate from the procedures outlined in this section.

Figure B.3 Indicative grid connection diagram



The project entity will meter electric power according to the following principles:

- **Power supplied to the grid and power received from the grid through the main power line:** As indicated in Figure B.3 the project is connected by 2 power supply lines (indicated in red) which will deliver power generated by 3 sets of turbine/generators to the grid. Net power supplied to the grid is metered as below:
    - The power supplied to the grid is measured by the project entity with standard electricity meter M1, M2 and M3 in accordance with national regulations at a point after power has been transformed to high voltage. Therefore, no further transformer losses will occur before the project is connected to the grid. As M1, M2 and M3 are all bidirectional the metering instrument will record readings for power supplied to the grid and power delivered from the grid. Calibration of M1, M2 and M3 is regularly carried out by qualified entity.

The measurement results by M1, M2 and M3 for electricity supplied to the grid and electricity delivered to the project from the grid will be cross-checked against Electricity Sales Transaction Settlement Notes (hereinafter refer to ETNs) provided each month by the grid company or sales receipts issues by project owner (which are printed according to ETNs' value). Maintenance of metering instruments M1, M2 and M3 will be undertaken by project entity periodically. Maintenance records will be kept for verification.

- **Installed capacity of the hydropower plant:**

In addition to the above, the installed capacity of the hydropower plant will be monitored yearly according to the applied methodology. The project entity will annually prepare photographic evidence of the installed equipment on the basis of the nameplates, which will be in accordance with domestic and international standards, or statements/documents by the manufacturer of the technology or the project entity.

- **Monitoring of reservoir surface area:**

The project entity will commission a qualified entity to conduct the monitoring of the surface area of the reservoir.

- **Reporting, archiving and preparation for periodic verification**

The project entity will in principle report the monitoring data annually but may deviate to report at intervals corresponding to agreed verification periods and will ensure that these intervals are in accordance with CDM requirements. The project entity will ensure that all required documentation is made available to the verifier. Data record will be archived electronically and be kept for a period of 2 years after the end of the crediting period to which the records pertain.

The project entity will collect internal records, ETNs that are provided by the grid company or sales receipts issues by project owner as evidence. The net supply (i.e. gross supply minus supply by the grid to the project) will be used in the calculations of emission reductions. All records of power delivered to the grid, ETNs, sales receipts and the results of calibration will be collated in a central place by the project entity.

An overview of detailed information on minimum accuracy requirements of the metering instruments, measuring intervals, recording form, calibration and available documentation is provided in Table B.9.

Determination of net power supply:

Net electricity supplied to the grid by the project ($EG_{facility,y}$ in section B.7.1.) is calculated by measurement results of electricity supplied to the grid minus electricity delivered from the grid to the project on a monthly basis:

- Electricity supplied to the grid by the project is through the main power line (in MWh) measured with the sum of M1, M2 and M3 by the project entity. The measured results will be cross-checked against ETNs or sales receipts.
- Electricity delivered to the project from the grid is through both main power line measured with the sum of M1, M2 and M3 by the project. This measured parameter will be cross-checked against ETNs or sales receipts.

In case of discrepancies between the measurement results of M1, M2 and M3 and the settled values on ETNs or sales receipts the conservative value will be used for emission reductions calculation.

Table B.18 Details of metering instruments

Meter	Measurement	Recording	Calibrations	Accuracy	Documentation
M1	Continuously	Monthly	Annual calibration conducted by a	Accuracy Class 0.5 or more accurate	Paper log books, cross-checked against ETNs or
M2	Continuously			Accuracy Class 0.5	

			qualified company	or more accurate	sales receipts
M3	Continuously			Accuracy Class 0.5 or more accurate	

The monitoring officer will log all corrective actions and will report these to the manager. In case issues regarding data collection and management, data quality control are raised and thus corrective actions are considered necessary, these actions will be implemented:

1. Identify parameters/data impacted
2. Identify causes and necessity of corrective actions.
3. Options of corrective actions will be listed
4. Cost-effective option will be chosen and will be implemented
5. Results of the chosen corrective actions will be evaluated.

The grid connection diagram indicates the principles for positioning of metering instruments that will be used in the monitoring of emission reductions. The project entity will ensure that the actual implementation of grid connection will not deviate from the procedures outlined in this section.

PROCEDURES IN CASE OF DAMAGED METERING EQUIPMENT / EMERGENCIES

Damages to metering equipment:

If the metering instrument M1, M2 and M3 are non-functional, the project entity will use readings from the backup metering instrument(s) that is installed onsite to cross-check against ETNs and the conservative value between the two will be used for emission reduction calculation. In the unlikely event that both metering instrument(s) are damaged, or in those cases where the project entity has not installed a backup meter, the electricity supplied to the grid or delivered from the grid to the project that is recorded by the grid company, evidenced by the ETNs, will be used for the days for which no data could be recorded.

Emergencies:

In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the below procedure for declaring the emergency period to be over:

1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

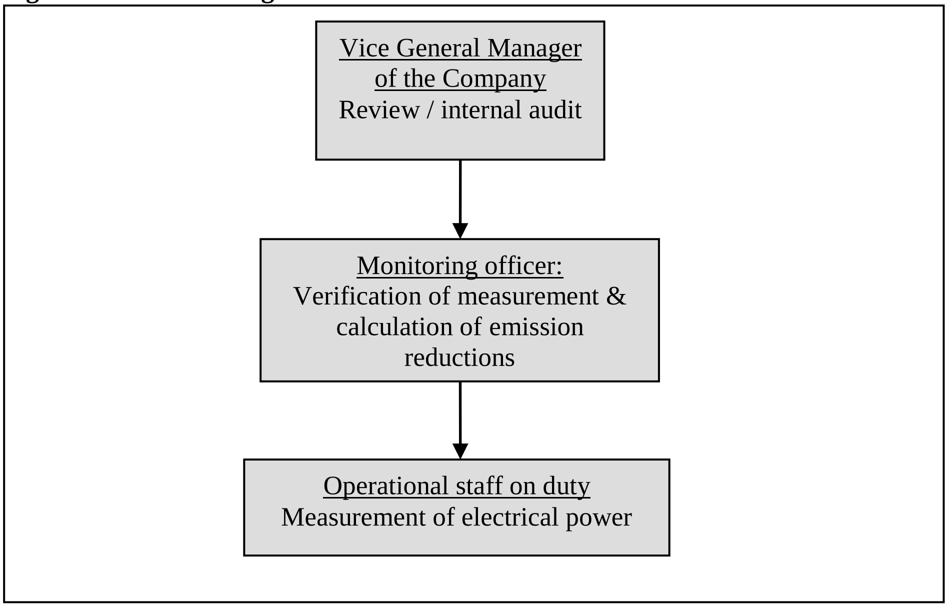
OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING

The monitoring of the emission reductions will be carried out according to the Scheme shown in Figure B.3. Staff at the station will receive monitoring training provided by external professional experts and training records will be provided to the verifier at verification. The director of the Safety Production department will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the electrical energy supplied to the grid and reporting of daily operations, which will be carried out by the plant operation staff.
The project owner will appoint a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the grid

to the hydropower plant and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the hydropower station including operating periods, power generation, power delivered to the grid, equipment defects, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Annex 4. Finally, the monitoring reports will be reviewed by the director of the Safety Production department.

The project entity will conduct maintenance of metering instruments periodically as well as oversee them so that instruments are not damaged. Maintenance records will be formulated.

Figure B.4: Management structure in order to monitor emission reductions:



B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion of the baseline study and monitoring methodology: 01/03/2011
Name of persons determining the baseline study and the monitoring methodology:

Caspervandertak BV

Tel: +86-10-84505756	Fax: +86-10-84505758	
Meskes	Managing Director China	meskes@cdmasia.org
YIN Li	Operations Manager	yinli@cdmasia.org
LI Zhenlan	Consultant	Zhenlan@cdmasia.org

Caspervandertak Consulting is not a project participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

22/05/2010.
(This was the earliest date when signed the main dam construction contract.)

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

37 Years 0 month

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

A renewable crediting period will be used.

C.2.1.1. Starting date of the first crediting period:

01/09/2013.
(Or the date of registration date, whichever is later.)

C.2.1.2. Length of the first crediting period:

7 years 0 months.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

An Environmental Impact Assessment (EIA) for the proposed project was carried out by Key Consultants Cambodia for Development and approved by Cambodian Ministry of Environment in January 17th 2011. The conclusion and recommendation are summarized as below:

SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT

1. **Biology Resources** (Forest, Wildlife habitat and Biological Wildlife)

The proposed project will construct the reservoir, the access road, the corridor of transmission line, and powerhouse and workers camps that might affect on wildlife and forest.

- Company will cooperation with Forestry Administration (FA) to establish a committee to manage forest Reforestation in open spaces nearby the project area, finishing sites (spoil areas, workers camps, access road for tunnel, etc), or in an area agreed by FA after the project construction stages. Company will consider a contribution budget in according with environmental management and other policy of the RGC. Strictly ban the project operation staffs do not encroach to the forest/habitat and migration route of the wildlife for land occupation or hunting particularly around the project areas. Company wills cooperation with FA, Conservation International, Wildlife Alliance, other conservation agencies, and local authority in Koh Kong and Pursat provinces to protect any encroachment to the forest for illegally cutting, land reclamation, and hunting in and around the project area.

2. **Physical Resources** (hydrological regime, water quality, climate)

It may change hydrological regime, water quality, climate in the project area due to the proposed project construction.

The company will provide adequate amount of delivery water to downstream between dam and power house that can ensure keeping the ecosystem of the stream alive and so not to have a high negative impact on the aquatic fauna and flora in that stretch of Stung Kep and Stung Tatay, at least $3m^3/s$ in dry season.

The forest and vegetation in proposed reservoir areas before the reservoirs will be filled to reduce decay of forest and vegetation in water. This will assist to protect water quality in the reservoirs and avoid high pollution of biological and nutrient parameters. Educate the project operation staffs do not dispose waste into the water course/reservoir, and provide adequate waste management facilities including sanitation latrines in the project site and workers camps. The company will make sure that all waste generated from humans will be properly collected and disposed of in order to safeguard the natural and social environment. Regularly monitor and investigate the water quality in the reservoirs and downstream of power houses. Take an action in time to improve the water quality in case of poor quality affecting the environment/people or breeding of diseases host/vector bloom in the water.

Regularly bottom flushing of the reservoir of the project in the wet season will be applied. Actually the project design ready provide bottom flushing system (diversion tunnel with inlet point in front of upstream cofferdam outlet point behind downstream cofferdam). Company will cooperate with Forestry Administration and forest conservation/protection institutions in the area to control and manage the forests including replanting forest where possible in and around the project site to balance ecosystem in the area. Good cooperation and collaboration with the local authorities in Thmabang and Koh Kong districts as well as Koh Kong province and Ministry of Agriculture Forestry and Fisheries to protect any illegally encroachment into the forest such as cutting and burning for hunting or land occupation.

3. Impact on public health

The water release from Tatay project is insignificant or minor impact animal and people health.

- Adequately disclose information to the people about anything harmful from the project activities to avoid health effects. Adequate safety signs will also be installed around the reservoir and dangerous places for the attention of local people and tourists. Medical treatment and protection methods will be provided to avoid spread of disease to other people. Provide health facilities, tools and equipment, medicines, and medicine/doctor for examination and treatment of project staff and local people. Good collaboration with the health institution in Thmabang and Koh Kong districts, Koh Kong province, and central level to protect any transmission disease in the project area. The company cooperates with policemen and local authorities to protect against drug injection and drug trafficking and alcohol abuse in the project area.

The properly implementation of proposed mitigation measure and environment plan that setting in EIA report can be reduced negative impact to some extent.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the project are not considered significant by the Cambodian government and the project participants. The Environmental Impact Assessment (EIA) was approved by the Cambodian Ministry of Environmental Protection.

SECTION E. Stakeholders' comments

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

Two public consultations were conducted through the EIA study period.

In aim of the first consultation meeting is disclosure of project information to the community base and review of environmental issues that may happen due to the project activities. Arrangement of the meeting was done through community leaders in the commune and village level. Two communities were selected for conducting separately, Russei Chrum commune in Thmabang district on 3 February 2009 and Tatay Kraom commune in Koh Kong district in 7 April 2009.

Table E.1 The meeting places, dates, and participants of the 1st public consultations:

Date	Province	District	Commune	Meeting place	Participants
3 Feb. 2009	Koh Kong	Thmabang	Russei Chrum	In Wat Thmabang, Trapeang Chhoeu Trav village	59 persons within 28 women
7 April 2009	Koh Kong	Koh Kong	Tatay Kraom	In Tatay Kraom Eco-Tourism Association office	58 persons within 38 women

The second public consultation was arranged in 15th Jun 2009 after finishing field work and getting adequately result of the study, engineering design and EIA for the project, to present to stakeholders. The representative of affected communities, all relevant departments in provincial level, private sectors, NGOs, and the project related institutions from Phnom Penh were invited.

Table E.2 The meeting places, dates, and participants of the 1st public consultations:

Date	Location			Participants			
	Province	Town	Meeting place	From government agencies	From community base	NGOs	Private Sector
15 June 2009	Koh Kong	Khemarak Phumin	In governor office building	17	15	4	1
				Total: 37 persons			

Note: the number of the study team is 6 persons and project owner is 1 person.

E.2. Summary of the comments received:

Table E.3.1 The results of first Public Consultation Meeting in 3 February 2009, in Russei Chrum commune, in Wat Thmabang.

Name and Position	Organization	Opinion, Comments, and Question	Solution	Source(EIA)
Mrs. Chum Phal	Villager, Koki Chrum village	- Nowadays my family income is depended on byproduct of forest in the project area. - If project activities	The company will be responsible for compensation to the direct and indirect affected people by providing budget to support agricultural	Page 133

		damaged non-forest products, what is the solution of project owner and Royal government of Cambodia (RGC)?	system development programs such as (i) animal raising (cattle, chicken, duck, and other animal); (ii) agricultural extension projects including rice, vegetables, and other crop production; and (iii) rural credit.	
Mr. Ouch Chroek	Villager, Trapeang Chhoetrav village	- Some villagers have fished in Stung Tatay, so the project will affect to the fishery in the area or not? - If project impact on the fishery resources here, what is the mitigation measure that project owner and RGC will use to solve this impact.	The company will responsible for providing budget in the appropriate period for running above program that all the villagers who living along the Stung Tatay can adopt with changing of food supply (wild-fish) and with new and sustainable daily livelihood.	Page 130
Ms. Tes Sokon	Villager, Koki Chrum village	- The project will submerge my village or my land lot or not?	No, the project will not encroach on the agricultural land as well as residential area	Page 116
Mrs. Ouk Son	Villager, Trapeang Chhoetrav village	- Request the project implementation company to recruit the workers among local people in Thmabang district, when the project starts the construction.	Yes. The company will recruit staffs from the local area to work for the project.	Page 157
Mr. Meng Ra	Chief of Russei Chrum commune	- Ask to the project implementing company providing technical person on the agricultural extension to train the villagers on animal feeding and crop growing.	The agriculture growth and fish feeding are not the responsibility of the hydropower station project owner.	-
People	in Thmabang district	- Request to the project owner to provide electrical power to people in Thmabang district with cheap price.	The electricity lower than current price will be exported to the grid and dispatched accordingly by the grid company, and will be finally supplied by the grid to the users.	-
All participants Russei Chrum commune, Thmabang	Russei Chrum commune, Thmabang district	- Ask to the project implementing company improve the Thmabang road from the junction of NR#48 to Thmabang district centre.	About 5.3Km Thmabang road from junction of NR#48 to entrance point of dam site was improved	S-3

Most of the questions were response by study team after each question. The people understand well on the project status and its activities. All the participants in this meeting support the project 100% and want to have this project soon.

Table E.3.2 Result of first public consultation meeting in 7 April 2009, in Tatay Kraom Eco-Tourism Association

<table>
<tr><th>Name and Position</th><th>Organization</th><th>Opinion, Comments, and Question</th><th>Solutions related to comments</th><th>Source(EIA)</th></tr>
<tr><td>Mr. Keo Bunthoeun</td><td>People from Anlongvak village</td><td>- Be afraid of breaking dam in operation period.
- How the hydroelectric dam is constructed?</td><td rowspan="7">Concerning to the dam management, the project owner will take the duties as below:
-Design criteria will be included the protection factor of earthquake and heavy storm in the area or in the region in compliance with the hydrology power plant design standard.
-Regularly control the dam quality will stay good enough according to the specification design standard.
-Regularly check the overflow structure be well function as original design, not logging by wood or other materials.
-Bottom flush facilities will open full capacity when reservoir starts to overflow through the spillway.
-Company will do good cooperation with local authority, policemen, and other responsibility agencies to protect any terrorism activities in project site.
-Company will provide information in time to the project staffs, local authority, and local people of any event that can lead to broken dam.
-Emergency support for escaping staffs and people from the disaster in project area will be provided too.
-The company or the government agencies will responsible to protect and compensate to the properties damage or loss of live, that may be happened by the above risk, in according with the investment contract condition between project investment</td><td rowspan="7">Page 147</td></tr>
<tr><td>Mr. Ly Em</td><td>People from Anlongvak village</td><td>- After the dam construction is completed, is there any affect on dragon fish?</td></tr>
<tr><td>Mr. Sum Chev</td><td>People from Anlongvak village</td><td>- Be afraid of breaking dam. If this happens, it would affect lives in the whole anlongvak village.</td></tr>
<tr><td>Mr. Khiev Neang</td><td>People from Anlongvak village</td><td>- Be afraid of breaking dam. Everything will be gone and nothing is remained.</td></tr>
<tr><td>Mrs. Mom Phan</td><td>People from Koh Andaet village</td><td>- Request the project owner to construct the dam as soon as possible.
- During the project operation, please provide electricity supply for local villagers with a cheaper price.</td></tr>
<tr><td>Mr. Khiev Non</td><td>Tatai Kroam commune chief</td><td>- Be afraid of getting flooded during dry season.</td></tr>
<tr><td>Mr. Sun Sym</td><td>People from Anlongvak village</td><td>- When will the project be constructed?</td></tr>
</table>

			company and Cambodian government.	
Mr. Heang Huon	Anlongvak village chief	- During the project operation, it will affect livelihoods of local people, especially for whom which may conduct fishing activities. How to solve such problem?	The company will be responsible for providing budget in the appropriate period for running above program that all the villagers who living along the Stung Tatay can adopt with changing of food supply (wild-fish) and with new and sustainable daily livelihood.	
Mr. Vang Oun	People from Koh Andaet village	- Request the project owner to construct the dam as soon as possible.	OK	
Mrs. Janet Newman	People from Anlongvak village	- If there are some objections from local people, will the project be reconsidered whether it should be constructed or not? - How about water fluctuation during dry and rainy seasons? - The project will affect aquatic life, how to solve such affects?	Yes The objective of the public consultation and stakeholders meeting in the project feasibility study stage is to disclose project information, collect comments or contribution ideas from stakeholders.	Page 176

Most of the questions were responded by study team after each question. The people understand well on the project status and its activities. They expected that their community will have adequately and cheap electrical power after the project finishing construction. All the participants in this meeting support the project and want to have this project soon.

In second public consultation, the result of the Feasibility Study of the Stung Tatay Hydroelectric both engineering and environmental aspect were disclosed with clearly illustration by presentation material (in power point, words/excels, and drawing/map), prediction of impact in construction and operation of the project, develop mitigation measure for each negative impact. Question, discussion, and comment are followed the presentation section. All the comments and question are recorded by the study team, and some questions and requests are responded. The outcome of the meeting is described as below:

Name and Position	Organization	Opinion, Comments, and Question	Solutions related to comments
Mr. Dom Yuk Hean	Representative of H.E Governor, Koh Kong province	The expression of the governor representative like that on behalf of Koh Kong province I'm very pleasure and have great honor to join the 2nd public consultation meeting on the Tatay Hydroelectric Development project. As reminded that after MoU signing for the Feasibility Study, the company has been prepared engineering study	-No questions raised

		and environmental study. The feasibility study was finished in December 2007 and the Initial Environmental Evaluation report was also got approval from MoE in March 2008. At the present, Cambodia is shortage power supply to domestic consumption, enterprise, and industries. Moreover the power demands is increase year to year while the supplier very small then the electrical charge very high comparing to the neighbour country. Truly Koh Kong province imported electricity power 6MW recently and will increase to 15MW in 2015. Refer to the power development master plan of Cambodia 2006, 13 important places of hydropower plants were selected in prior for power development from 2007-2022. Tatay hydroelectric development project is one of priority hydropower plant which is responded to the Country energy demand in 2007-2020. What I understand is that the project can be reached to implement unless the study on environmental impact assessment is done in compliance with the law on Environmental Protection and Natural Resources Management, and examined by Ministry of Environment and line-ministry before submitted to the Royal Government make decision. Therefore today meeting is very important for all participants to give an ideas, comments, and good experiences to contribute to the both engineering and environmental study for the whole project. I strongly hope that the meeting will smoothly process and receive good result.	
Mr. Phon Lyvirak	Director of Agriculture dep. Koh Kong province	Request to Cambodian Tatay Hydroelectric Limited and North West Hydropower engineer clearly summary the engineering design with selection option for all project components.	The FSR was provided.
Mr. Seng Kim Rithy	Representative of MIME	He expressed that at the moment the Tatay Hydroelectric	The electricity price will be fixed during the whole implementation

		development project has total investment cost of USD 540 million with electrical selling rate to EDC 0.074$/kw, if the other study including environmental study will add more cost for compensation to the project investment budget then the cost of the selling electricity power to the EDC will be higher, and EDC cannot buy it.	period according power purchase contract.
Ms. Janet Newman	Owner of Rainbow Lodge in Tatay Kroam	First of all I would like to thanks to meeting today that allows me to contribute idea on this hydropower plant, and I do agree all the mitigation measure on the impact that raised by the study teams. What I want to talk more on the natural tourism in the area such as cascade, forest, etc., which being interested to the foreign tourists and I had contacted by Bangkok Airway and China Airway for taking photography here. In May last month the journalist of Singapore Time taken the scenery here too, and from those information I had foreign tourist of 200 persons per year even my business is small (Guesthouse and tourism guide). The guests staid in rainbow lodge they visited Koh Kong town, mangrove forest in Bung Pa-Yak, Thmabang, and Chiphat. Therefore request to build the powerhouse in place where will not impact to the cascade and water quality. However I admire to the project study teams/ company try to minimize the impact from the project site selection. My final worried on the water release from the powerhouse of 150m3/s may is a big flow that can cause danger to the tourist who take boat in downstream of powerhouse. Request to the company properly consider: - it can be moved the powerhouse upward to nearby the dam site? - How to give information on the time schedule for release water from the powerhouse to avoid danger?	Dam risk management was clarified in Table E.3.2. The tailwater pool at outlet of the powerhouse has an important role to reduce the peak water flow. Moreover the Water level at downstream of the powerhouse just fluctuation with sea tide only (0.5-0.9m daily in year round), except 2-5 days in July and August flooded 2-3 meters due to heavy rain in catchments area. Therefore the water release from Tatay project is insignificant or minor impact to people safety. Besides, adequate safety signs will also be installed around the reservoir and dangerous places for the attention of local people and tourists. Tourist management: There is not tourism facility in the in the reservoir site of project. However, the natural resources near by the project area can provide a potential for ecotourism development. (EIA Page 100)
Mr. Danh Serey	Deputy director of EIA dep. of MoE	First of all I want all the participant give idea, suggestion, and comment, and the response to the questions may be provided later. I	- Environmental fund Company will make a contribution budget in according with environmental management and other

		found that company not yet indicate the environmental endowment fund for protection requirement, and how much? Concerning to the issues that the MIME and IOs representatives raised: the MIME representative expressed that if investment cost increase than USD 540 million then the electricity selling cost also increase. However MoE as well as IOs and others stakeholders not avoid/omit environmental protection, so request to the study teams specify the environmental protection fund. Anyway what IOs had raised also correct MoE want company do more study on impact with Cost Benefit Analysis (CBA). The CBA on environmental impact value and benefit value, it can be studied on Use Value and Non-use Value with direct, indirect and optional value too. Do like this can be responded to what IOs raised in this meeting. At the moment the company ongoing study, so I request to study team include CBA in the project study too, When finish study will submit all the reports to MoE review and comment in cooperation with line-ministries to avoid restudy will lead waste time. The presentation showed the water quality analysis results, but for the air quality just said in word good quality without examination results. Request to the study team do air quality examination to measure existing condition before the project implement. By the ways, if the MIME found that the area has potential minerals than power plant investment, how to do?	Cambodian policy. This budget will be used for managing and improving environment in or near by the project area.(EIA Page S-14) -Air quality The company will use appropriate blasting material and techniques so no high pollution is emitted to the air. Good quality equipments and vehicles will be used for project. Project owner will properly cover on the construction materials such as the cement, soil during transportation. Watering on the project access road during dry periods. (EIA Page 120) Potential minerals: According to the minerals map that prepared by the Department of Geology and Mines of MIME was indicated that within the project areas present only four minerals such as: Jet, Sapphire-Ruby-Zircon Spinel Association, Clay, and Pagodite. However the proposed alignment and project activities will not affected to those minerals deposits site. (EIA Page S-6)

Mr. Meas Sitha	Vice chief of Khan Forestry Administration. Koh Kong province	Request to the company that for construction access road and cutting forest must contact Forestry Administration to evaluate, because in the past like Atay hydropower plant project they use only some valuable trees, but for non valuable trees they push out. The constraint is cannot manage the forest cutting, and they escape of tax payment on the small trees.	Forest cutting (EIA Page 121) The company will do closely cooperation with Forestry Administration to establish a committee to manage forest that will be cut in the project sites. For example the committee can asks private company to bid for cut, collect, and sell timber to the market. The money collection from physical value of the cutting forest in the project sites will come to the national budget. The cutting forest will be done within areas of the project site where construction activities are required and after approval from the above committee. Strictly ban construction workers from encroaching into the forest or cutting forest for hunting or occupation land.
Mr. Eng Polo	Community engagement coordinator/CI	On behalf of Community engagement I request to EIA study team to clearly study on water at downstream of the dam, because in 1st and 2nd year of project operation with poor quality of water. - Which animal that will be affected? - What an economic value?	Water quality (EIA Page 128) During the first 1-3 years of operation the water in the reservoirs may be poor due to decay of forest or vegetation and small animals that are trapped in the flooded reservoir area. However the water quality in the reservoir will recover to some extent in years 4-5 of the operation period. Low dissolved oxygen and bad smell in the water will likely occur downstream of power house but for a short time so only a small affect is expected based on the natural recovery of the stream and sea water treatment. The company will make sure that all waste generated from humans will be properly collected and disposed of in order to safeguard the natural and social environment. Regularly monitor and investigate the water quality in the reservoirs and downstream of power houses. Take an action in time to improve the water quality in case of poor quality affecting the environment/people or breeding of diseases host/vector bloom in the water.
Ms. Janet Newman	Owner of Rainbow Lodge in Tatay Kroam	In the previous meeting in Tatay Kraom commune the company said that after project implement, the commune will have electrical power for using but no clear with electrical charge. How much for	The questions were replied by Mr. Seng Kim Rithy as representative of Ministry of Industrial Mines.

		electrical charge per kW? I see that all power production from Hydropower plant in area are transmitted to O'Som station, no providing to local community. Another thing transmission line along the NR#48 to Koh Kong town then to O'Som is very high cost than short way from powerhouse to O'Som. Question: Is RGC can provide extra cost to company? She added that so strange there are 4 hydropower plants in Koh Kong but do not have the distribution electricity from the project into Koh Kong	
Mr. Seng Kim Rithy	Representative of Ministry of Industrial Mines and Energy	Concerning to the transmission line alignment from the powerhouse to the O'Som substation is following the master plant of the MIME, and department of electrical transmission is responsible in term of technical design and evaluation in compliance with the Cambodia standard. O'Som substation will collect all the power from the hydropower plants in the area, and the transmission to Phnom Penh and Battambang	-Answering the Ms. Janet Newman's question.
Mr. Hunter Weiler	Technical Advisor, Forestry Administration	He asks to the study team to give brief process for the next step before the implementation this project. - When the study will be finished? - When the EIA report will be submitted to MoE for reviewing? - How long that the EIA report will be approved?	The schedule of EIA report and approval were replied by the study team.
Mr. Dom Yuk Hean	Representative of H.E Governor, Koh Kong province	He thanks to the participants and appreciated all the contribution idea and comment. This meeting was very active and received fruitful results, he said. Request to the study team to consider on the useful comment from the meeting. I'm surely hope that the RGC have plan on the distribution electricity power to all town, community, and village as goal of reduction poverty.	No questions

Some of the questions were responded by design engineers and EIA study team. Some points were clarified by representatives of Ministry of Industrial Mines and Energy (MIME). More study on Cost Benefit Analysis (CBA) was raised by Ministry of Environment (MoE) representative. The participants were appreciated on clearly disclosure the results of the study and clearly answered to the question and they were satisfied with the responses and therefore supportive for the implementation of the project.

In general the local people and stakeholders welcome the Tatay Hydroelectric Project, and provide comment to the study team/company as described above.

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

Given the generally positive nature of the comments received, project owner will follow the measures in Table E.2.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Entity:

Organization:	Cambodian Tatay Hydropower Limited
Street/P.O.Box:	No. 16, Street 592, Sangkat Beungkok, Khan Toul Kok, Phnom Penh
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project does not receive any public funding from Annex I countries.

Annex 3
BASELINE INFORMATION

Our baseline calculation follows the methodology used in the OM and BM emission factors baseline calculation published by Climate change department in March, 2010. Full information on the calculation of the baseline and underlying data can be found at:
http://www.camclimate.org.kh/index.php?page=documentation&mcat=cat47&scat=cat51&lang=en

Section 1: Descriptions of the electricity generation plants supplying power to the Phonon Penh Grid System[26]

- The C3 power station is located in the Boeng Tumpun commune, Mean Chey district, with an installed capacity of 15.4MW. The electricity is generated from diesel generators, and the electrical output was 21.8GWh, 43.4GWh and 22.6GWh in 2007, 2008 and 2009 respectively.

- The C5 power station has two 5MW generators with a total installed capacity of 13MW. The plant was granted by Japan in 1995 and commissioned in 1996. The electrical output of the plant was 20.1GWh, 24.4GWh and 19.8GWh in 2007, 2008 and 2009 respectively.

- The C6 power station is adjacent to C5 and is comprised of three generator sets which were recently converted from Diesel Oil (DO) to Heavy Fuel Oil (HFO). The total installed capacity of the plant is 18.6MW. It was commissioned in 1996. The plant generated 51.8GWh, 76.0GWh and 43.7GWh of electricity in 2007, 2008 and 2009 respectively.

- The Cambodia Utilities Pte Ltd. (CUPL) is comprised of seven 5 MW generators operating on HFO. This plant was commissioned in 1996/97 and is located at the Chak Angrae Leu commune in the Mean Chey district. The electricity output generated was 258.5GWh, 258.7GWh and 182.2GWh in 2007, 2008 and 2009 respectively.

- The Kirirom 1 Hydropower Plant is operated by CETIC (China Electric Power Technology Import & Export Corporation) International Hydropower Development Co., Ltd. The company obtained permission to rebuild the project which was recommissioned in May 2002 with a capacity of 12MW and an upgraded 115kV transmission line to Phnom Penh. The project generated about 46.5GWh, 43.3GWh
- and 44.4GWh in 2007, 2008 and 2009, respectively.

- Khmer Electrical Power Co., Ltd. operates an electrical power generating plant of total capacity of 48 MW, consisting of six Wartsila-type diesel generator units rated at 8 MW, located in Phum Dam Nak Thom, Sangkat Steung Mean Chay, Khan Mean Chay, Phnom Penh for supplying electricity to the distribution system of EDC. It was commissioned in 2005. The normal fuel for the plant is HFO. The electrical output of the plant was 278.0GWh, 317.8GWh and 256.2GWh in 2007, 2008 and 2009 respectively.

- City Power Group Corporation operates an HFO Power Plant of total capacity of 8.1 MW, consisting of three 9H25/33-type diesel generator units rated at 2.7MW, in Phum Tror Peang Chrey, Sangkat Kar Kap, Khan Dang Kor, Phnom Penh for supplying electricity to the distribution system of EDC. It was commissioned in 2005. The normal fuel for the Plant is HFO. The electrical output of the plant was 38.2GWh, 41.8GWh and 34.1GWh in 2007, 2008 and 2009 respectively.

[26] Sourced from EAC

- Colben Energy (Cambodia) Limited operates an HFO power plant with a total installed capacity of 14.8MW, consisting of two diesel generators (SEMT Pielstick) rated at 5.4MW and one diesel generator (IHI-SEMT Pielstick) rated at 4MW, located in land lot No. 283, Phum Boung Salang, Sangkat Russey Keo, Khan Russey Keo,

- Phnom Penh is for supplying electricity to EDC's distribution system in Phnom Penh. It was commissioned in 2006. The normal fuel for the Plant is HFO. The electrical output of the plant was 54.0GWh, 45.7GWh and 53.2GWh in 2007, 2008 and 2009 respectively.

- SHC (Cambodia) International Pte Ltd. operates a diesel power plant of total capacity of 13.639 MVA, consisting of 18 diesel generator Units with 21 diesel engines with installed capacity of 619 kVA each -1 diesel engine with installed capacity of 640 kVA, located in the EDCˇs Power Plant No 1, No 3 and No 5 in Phnom Penh for supplying electricity to the distribution system of EDC. It was commissioned in 2006.The normal fuel for the operation of the Power Plant is DO. The electrical output of the plant was 14.7GWh, 34.5GWh and 17.3GWh in 2007, 2008 and 2009 respectively.

- (Cambodia) Electricity Private Co., Ltd operates an electrical power generating plant with a total installed capacity of 60.2MW and contracted capacity of 45MW, consisting of six Wartsila-type diesel generator units rated at 10.040MVA, located in Phum Tuol Pongro, Sangkat Chom Chao, Khan Dang Kor, Phnom Penh for supplying electricity to the distribution system of EDC. It was commissioned in 2006. The normal fuel for the Plant is HFO. The electrical output of the plant was 315.6GWh, 325.9GWh and 269.5GWh in 2007, 2008 and 2009 respectively.

- SL Garment Processing (Cambodia) Ltd operates a thermal generating plant of a total installed capacity of 4.5MW, consisting of two thermal generators rated at 3MW and 1.5MW, located in Phum Russey, Sangkat Steungmeanchhey, Khan Meanchhey, Phnom Penh for supplying electricity to the distribution system of EDC. It was commissioned in 2006. The normal fuel for the Plant is wood. The electrical output of the plant was 5.1GWh, 4.4GWh and 5.8GWh in 2007, 2008 and 2009 respectively.

- Sovannaphum Investment Co., Ltd operates a thermal generating plant of total installed capacity 13MW, and consists of two thermal generators (10MW and 3MW), located in Khum Samrong Thom, Keansvay District, Kandal Province for supplying electricity to distribution system of EDC. It was commissioned in 2008. The normal fuel for the plant is coal. The electrical output of the plant was 23.4GWh in 2008 and
- 28GWh in 2009.

- Colben Energy (Cambodia) PPSEZ Limited operates a power generating plant of total installed capacity of 13MW, consisting of two generators (6.5MW each), located in Phnom Penh Special Economic Zone for supplying electricity to EDC. It was commissioned in 2008. The normal fuel for the Plant is HFO. The electrical output of the plant was 35.7GWh in 2008 and 45.1GWh in 2009.

- Three small generator houses, Electricity Tramkhnar (DO), Mr. Bun Huy (DO) and Mr. Toeng Samouv (DO), started to supply electricity to the Phnom Penh Grid System in 2009, due to the grid extension.

Section 2: Worksheet for Emission Factor Calculation

CO2 emissions from Power Plants in Phnom Penh in 2007									
			A	**B**	**C**	**D**	**E**	**F**	**G**
		i	EG_m	$FC_{i,m}$	NCV_i	$EF_{CO2,i}$	η_m	$EF_{EL,m}$	
Name of Power Plant	Option	Fuel Type	Electricity generated MWh	Fuel Consumption t	Net Calorific Value GJ/t	CO2 Emission Factor t Co2/GJ	Ave.Net Energy Conversion Efficiency %	CO2 Emission t CO2/MWh	CO2 Emission tCO2
								A1: F=(B*C*D)/A A2:F=D*3.6/E	G=A*F
Electricité du Cambodge									
C3	A1	DO	21,770	4,950	41.4	0.0726		0.6834	14,878
C5	A1	HFO	20,130	4,423	39.8	0.0755		0.6602	13,290
C6	A1	HFO	51,820	12,042	39.8	0.0755		0.6982	36,181
Cambodia Utilities Pte. Limited	A1	HFO	258,490	61,053	39.8	0.0755		0.7097	183,450
Khmer Electrical Power Co., Ltd	A1	HFO	277,991	63,186	39.8	0.0755		0.6829	189,840
City Power Group Corporation	A1	HFO	38,238	8,904	39.8	0.0755		0.6997	26,755
Colben Energy (CAMBODIA) Ltd	A1	HFO	54,019	14,097	39.8	0.0755		0.7841	42,356
SHC (Cambodia) International Pte Ltd	A1	DO	14,700	3,675	41.4	0.0726		0.7514	11,046
(Cambodia) Electricity Private Co, Ltd	A1	HFO	315,550	72,522	39.8	0.0755		0.6906	217,919
Total			1,052,708						735,714
							EFgrid, OMsimple, 2007	**0.6989**	

**IPCC 2006.*
***Both default Net Calorific Value (NCV) and CO2 Emission Factor for Heavy Fuel Oil (HFO) refers to the values equivalent to those with Residual Fuel Oil.*
****Coal refers to the values of Lignite.*

CO2 emissions from Power Plants in Phnom Penh in 2008									
			A	B	C	D	E	F	G
		i	EG_m	$FC_{i,m}$	NCV_i	$EF_{CO2,i}$	η_m	$EF_{EL,m}$	
Name of Power Plant	Option	Fuel Type	Electricity generated MWh	Fuel Consumption t	Net Calorific Value GJ/t	CO2 Emission Factor t Co2/GJ	Ave.Net Energy Conversion Efficiency %	CO2 Emission t CO2/MWh	CO2 Emission tCO2
								A1: F=(B*C*D)/A A2:F=D*3.6/E	G=A*F
Electricité du Cambodge									
C3	A1	DO	43,410	9,684	41.4	0.0726		0.6705	29,107
C5	A1	HFO	24,440	5,079	39.8	0.0755		0.6245	15,262
C6	A1	HFO	75,990	17,085	39.8	0.0755		0.6756	51,339
Cambodia Utilities Pte. Limited	A1	HFO	258,713	60,794	39.8	0.0755		0.7061	182,680
Khmer Electrical Power Co., Ltd	A1	HFO	317,848	72,117	39.8	0.0755		0.6818	216,704
City Power Group Corporation	A1	HFO	41,816	9,773	39.8	0.0755		0.7023	29,367
Colben Energy (CAMBODIA) Ltd	A1	HFO	45,696	12,362	39.8	0.0755		0.8129	37,147
SHC (Cambodia) International Pte Ltd	A1	DO	34,501	8,625	41.4	0.0726		0.7514	25,924
(Cambodia) Electricity Private Co, Ltd	A1	HFO	325,883	74,840	39.8	0.0755		0.6901	224,887
Sovanna Phum Investment Co., Ltd	A1	Coal	23,359	27,727	5.5	0.0909		0.5934	13,862
Colben Energy (Cambodia) PPSEZ Limited	A1	HFO	35,658	8,915	39.8	0.0755		0.7513	26,789
Total			1,227,314						853,066
							EFgrid, OMsimple, 2008	**0.6951**	

**IPCC 2006.*

***Both default Net Calorific Value (NCV) and CO2 Emission Factor for Heavy Fuel Oil (HFO) refers to the values equivalent to those with Residual Fuel Oil.*

****Coal refers to the values of Lignite.*

CO2 emissions from Power Plants in Phnom Penh in 2009									
			A	**B**	**C**	**D**	**E**	**F**	**G**
		i	EG_m	$FC_{i,m}$	NCV_i	$EF_{CO2,i}$	η_m	$EF_{EL,m}$	
Name of Power Plant	Option	Fuel Type	Electricity generated MWh	Fuel Consumption t	Net Calorific Value GJ/t	CO2 Emission Factor t Co2/GJ	Ave.Net Energy Conversion Efficiency %	CO2 Emission t CO2/MWh	CO2 Emission tCO2
								A1: F=(B*C*D)/A A2:F=D*3.6/E	G=A*F
Electricit é du Cambodge									
C3	A1	DO	22,610	4,988	41.4	0.0726		0.6631	14,992
C5	A1	HFO	19,840	4,543	39.8	0.0755		0.6881	13,651
C6	A1	HFO	43,700	10,267	39.8	0.0755		0.7060	30,851
Cambodia Utilities Pte. Limited	A1	HFO	182,224	43,169	39.8	0.0755		0.7119	129,719
Khmer Electrical Power Co., Ltd	A1	HFO	256,247	57,313	39.8	0.0755		0.6721	172,220
City Power Group Corporation	A1	HFO	34,113	8,124	39.8	0.0755		0.7156	24,412
Colben Energy (CAMBODIA) Ltd	A1	HFO	53,235	13,851	39.8	0.0755		0.7818	41,621
SHC (Cambodia) International Pte Ltd	A1	DO	17,307	4,324	41.4	0.0726		0.7509	12,996
(Cambodia) Electricity Private Co, Ltd	A1	HFO	269,480	62,337	39.8	0.0755		0.6951	187,316
Sovanna Phum Investment Co., Ltd	A1	Coal	28,033	35,041	5.5	0.0909		0.6249	17,519
Colben Energy (Cambodia) PPSEZ Limited	A1	HFO	45,061	11,567	39.8	0.0755		0.7713	34,758
Imported from Vietnam	Imported		374166			0			
Electricity Tramkhnar	A2	DO	537		41.4	0.0726	39%	0.6702	360
Mr. Bun Huy	A2	DO	8		41.4	0.0726	39%	0.6702	5

Mr. Toeng Samouv	A2	DO	176		41.4	0.0726	39%	0.6702	118
Total			1,346,737						680,538
							EFgrid, OMsimple, 2009	**0.5053**	

**IPCC 2006.*
***Both default Net Calorific Value (NCV) and CO2 Emission Factor for Heavy Fuel Oil (HFO) refers to the values equivalent to those with Residual Fuel Oil.*
****Coal refers to the values of Lignite.*

Power Plant	Year of operation	Fuel Type	Electricity Generated, MWh	CO2 Emission Factor, tCO2/MWh	Emission reduction
Colben Energy (Cambodia) PPSEZ Limited	2008	HFO	45,061	0.7713	34,756
Sovanna Phum Investment Co., Ltd	2008	Coal	28,033	0.6249	17,518
Mr. Toeng Samouv	2007	DO	176	0.6702	118
Mr. Bun Huy	2007	DO	8	0.6702	5
SL Garment Processing (Cambodia) Ltd	2006	Wood	5,758	0	-
(Cambodia) Electricity Private Co, Ltd	2006	HFO	269,480	0.6951	187,316
Total			348,517		239,712
				BM (tCO2 /MWh)	**0.6878**

Annex 4

MONITORING INFORMATION

Selection procedure:
The monitoring officer will be appointed by the general manager of Cambodian Tatay Hydropower Limited. The monitoring officer will be selected from among the senior technical or managerial staff.

Tasks and responsibilities:
The monitoring officer will be responsible for carrying out the following tasks

- **Supervise and verify metering and recording:**
  The monitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.
- **Collection of additional data, sales / billing receipts:**
  The monitoring officer will collect sales receipts for power delivered to the grid, billing receipts for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the hydropower station.
- **Calculation of emission reductions:**
  The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.
- **Preparation of monitoring report:**
  The monitoring officer will annually prepare a monitoring report which will include among others a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration and a calculation of emission reductions.