CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

4MW AMDB Perting Mini Hydro Project

Version 2.2

Date:22/07/2010

A.2. Description of the small-scale project activity:

Description and purpose of the project activity:

The proposed project involves implementation and operation of run-of-river type net export capacity of 4MW mini hydro grid-connected renewable energy project on the Perting River, in the district of Bentong, Pahang state, Malaysia. The mini hydro project will be developed by AMDB Perting Hydro Sdn. Bhd.

The main objective of the project is to generate clean electrical energy in a sustainable manner, optimizing the utilization of renewable resource, water, and contribute to climate change mitigation measures. The installed capacity of the project is 4.2MW, with a net export capacity of 4MW, employing 2 units of turbine, each with a rated capacity of 2181 kW able to produce an average annual net electricity generation of 28,032 MWh. The electricity generated will be sold to the national utility, Tenaga Nasional Berhad (TNB) under a 21-year Renewable Energy Power Purchase Agreement (REPPA). Thus, the electricity generated by the mini hydro power plant will displace part of the electricity generated by the grid dominated by the conventional fossil fuel-fired power plants. The estimated annual greenhouse gas (GHG) emissions reduction is 17,380 tonnes of CO_2 equivalent.

The project activity is in line with the Government of Malaysia's initiative in Small Renewable Energy Power Programme (SREP) which aims at encouraging the development of electricity generation from renewable sources. In the SREP program, small power generation plants which utilise renewable energy can apply to sell the electricity to the national Utility through the Distribution Grid System. Maximum capacity of a SREP project designed for sale of power to the grid must be 10MW.

Contribution to sustainable development:

The project will generate renewable and clean electricity and thus, contributes to sustainable development which includes:

Environmental sustainability

The project activity will have a positive impact on the environment as it will displace part of electricity generated by the conventional power plants in the national grid, thus avoid environmental pollution caused by the burning of fossil fuel and lead to an increased sustainability in the power generation sector. The hydro electric project has no negative environmental impacts because it relies on existing river release and it does not involve any tree cutting or any submersion etc.

The project activity will also contribute towards meeting the target of the Ninth Malaysia Plan[1] to achieve 350MW of electricity from renewable sources by the end of 2010.

Social sustainability

Generation of direct and indirect employment would occur due to the project activity. There will be a need for both skilled and unskilled labour, thus creating job opportunities to the locals during construction and operations of the power plant. This project is expected to employ at least 20 people of various qualifications through the lifetime of the project activity. The workforce will have to be trained to operate the new plant and new qualified staff will be employed.

Economy spill over of the project will also increase business opportunities for local suppliers in transportation, maintenance and repair, parts supply, food and other services.

Economic sustainability

The project activity will lead to economic sustainability as the fuel source i.e. water is a sustainable, indigenous resource, which helps conserve the country's foreign exchange by reducing reliance on imported fossil fuels for electricity generation.

The project has created business opportunities for local stakeholders such as bankers, consultants, suppliers, manufacturers, contractors, etc.

A.3. Project participants:

Table A.1 Project Participants

Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*) (as applicable)**	**Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Malaysia (Host Party)	Private entity: AMDB Perting Hydro Sdn Bhd	No
United Kingdom (Annex 1)	EnergiMidt Handel A/S	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Malaysia

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

[1] 9th Malaysia Plan 2006 – 2010, Economic Planning Unit, Prime Ministers Department, 2006 : Pg 408, Section 19.46.

Pahang

A.4.1.3. City/Town/Community etc:

Bentong

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project is located near a waterfall on the main stream of Perting River, 14 km from Bentong town in the state of Pahang, Malaysia.

The exact location of the project is defined using GPS coordinates; i.e. the water catchment location at 03.5104°,101.8391° and the Powerhouse location at 03.5103°,101.8562°.

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

a) Type and category of the small-scale project:

Type I – Renewable Energy Projects
Category I.D. – Grid connected renewable electricity generation

According to Appendix B of the simplified procedures for small scale activities, the proposed project activity falls under Category I.D based on the following reasons:

- The proposed project makes good use of the water head to generate electricity with installed capacity of 4.2 MW, i.e. less than 15 MW, and accords with the eligibility of small scale CDM Project activities. It will not increase the installed capacity beyond 15 MW at any point of time during the crediting period.
- The plant will sell its generated electricity to the national grid that would have otherwise been supplied by at least one fossil fuel fired generating unit.

b) Technology description

The project is run-of-river hydropower project with a total installed capacity of 4.2MW and a designed operation lifetime of 21 years. The project consists of the construction of Power Intake and Weir Structure, a Penstock and a Powerhouse.

Table A.2 below summarises the key technical data for the equipment adopted by the project.

Table A.2: Key technical data of the proposed project

Hydrology	
Intake Location	3.5104°, 101. 8391°
Power Station Location	3.5103°, 101. 8562°
Name of Hydrological Region	Perting River, Bentong, Pahang.
Potential Water Resources	1200 – 1600 mm/yr
Physiographic	Hilly and mountain Complexes
Intake Structures	
Intake span	19m across stream
Settling Basin	The 19 m intake has a settling basin designed to allow sufficient time for 0.5 mm size particles to settle and flush out
Overflow weir	2.5 m height constructed across the river to divert water into settling basin

Water Head	168m (gross), 159.6m (net)
Flow	3.2 m^3/sec
Penstock	
Length	3800 m
Diameter	1400 mm
Material	Steel Pipe coated with epoxy
Support	Concrete support 7m centre to centre and thrust blocks at bends.
Power Station	
Structure	Reinforced concrete sub-floor structure with a light timber framed and galvanised iron clad and roofed superstructure.
Power house	To house generating units
Water Turbine Equipment and Auxiliaries	
Turbine	Type : Wasserkraft Volks AG Units : 2 Turbine output: 2,181 kW
Generator	Type : Wasserkraft Volks AG Units : 2 Generator Output: 2,500kVA

The project will install 2 units of turbines and generators imported from Germany. The generator voltage is 690 V and will be connected to the TNB sub-station (11 kV) at a distance of 14km.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

The project activity will employ a 7-year renewable crediting period. Total estimated emission reductions in the crediting period are tonnes of CO_2 equivalent, as tabulated below.

Table A.3 : Estimated Emission Reductions

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Year 1	17,380
Year 2	17,380
Year 3	17,380
Year 4	17,380
Year 5	17,380
Year 6	17,380
Year 7	17,380
Total estimated reductions (tonnes of CO_2 e)	**121,660**
Total number of crediting years	**7**

Annual average of the estimated reductions over the crediting period (tCO_2 e)	17,380

The start date of the crediting period is expected to be the day the project is registered by the UNFCCC.

A.4.4. Public funding of the small-scale project activity:

The Project has not received public funding from Parties included in Annex I.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Appendix C of the Simplified Modalities and Procedures of Small-Scale CDM project activities, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale project activity or an application to register another small-scale project activity:

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

The project owner has not developed other small-scale projects within a distance of 1 km of the proposed project. Thus, the proposed small-scale project activity is not a debundled component of a large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Small-scale methodology AMS-I.D (Version 15). "Grid connected renewable electricity generation"

Type I – Renewable Energy Projects
Sub Category – I.D – Grid connected renewable electricity generation (Version 15).

The reference has been taken from the list of small scale CDM Project activity categories contained in "Indicative and Simple Baseline and monitoring methodologies for small scale CDM project activities - Version 13, dated 14 December 2007[2]

B.2 Justification of the choice of the project category:

[2] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

The project category: AMS I.D. "Grid connected renewable electricity generation" is chosen based on its compliance with the applicability criteria set out below:

Table B.1: Justification of the choice of the project category

Applicability criterion	**Project compliance with the criterion**
This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	The project activity comprises renewable energy generation unit, i.e. hydroelectric and the electricity generated is supplied to the grid that is or would have been supplied by at least one fossil fuel fired generating unit (TNB's Peninsular Malaysia grid), thus it meets the criterion.
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume for reservoir is increased and the power density of the project activity is greater than $4W/m^2$; • The project activity results in new reservoirs and the power density of the power plant is greater than $4W/m^2$	This is not applicable as the project activity is a run-of river hydro project and it is not implemented in an existing/new reservoir.
If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	This is not applicable as the project activity does not have any non-renewable component.
Combined heat and power (co-generation) systems are not available under this category.	The project activity is not co-generation system.
In the case of project activities that involves the addition of renewable energy generation units at an existing renewable power generation facility; the added capacity of the units added by the project should be lower than 15MW and should be physically distinct from the existing units.	This is a greenfield power project with an installed capacity of 4.2 MW which is lower than the 15 MW thresholds.

Applicability criterion	Project compliance with the criterion
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15MW.	This is a greenfield power project with an installed capacity of 4.2 MW which is below than the 15 MW thresholds.
The Project boundary encompasses the physical, geographical site of the renewable generation source.	The project boundary essentially covers the diversion weir, penstock, powerhouse & tailrace and the transmission line including the interconnection point with TNB sub-station.

Based on the discussion in TableB.1 above, the AMDB Perting Mini Hydro Project clearly falls under the category: AMS I.D. "Grid connected renewable electricity generation".

B.3. Description of the project boundary:

According to the AMS I.D. – the project boundary encompasses the physical, geographical site of the renewable generation source. Hence the project boundary essentially covers the diversion weir, penstock, powerhouse & tailrace and the transmission line including the interconnection point with TNB sub-station.
No emissions have been envisaged within the project boundary as there is no construction of dam; the project boundary is illustrated in the following diagram:

Figure B.1: Project boundary

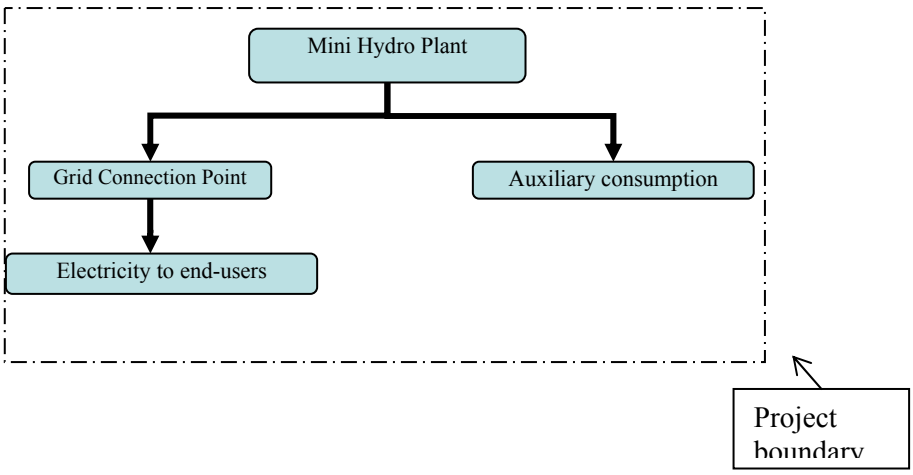


Table B.2.: Sources and types of GHG emissions in baseline and project scenarios

	Source	Gas	Included?	Justification/Explanation
Baseline	Power from the grid	CO_2	Yes	Emissions from generation of electrical power in the grid are included in the baseline
		CH_4	No	Excluded for conservativeness
		N_2O	No	Excluded for conservativeness
Project Activity	Power from the grid	CO_2	No	There will be no power consumption from the grid
		CH_4	No	Excluded for conservativeness
		N_2O	No	Excluded for simplicity – expected to be minimal
	Dam	CO_2	No	No reservoir or dam is built as this is a run of river hydro project.
		CH_4	No	There will not be any emission from degradation of organic mater as this project does not consist of construction of a reservoir or dam.
		N_2O	No	Excluded for simplicity – expected to be minimal
	Fossil Fuel	CO_2	No	There will not be any fossil fuel consumption
		CH_4	No	Excluded for simplicity – expected to be minimal
		N_2O	No	Excluded for simplicity – expected to be minimal

B.4. Description of baseline and its development:

The baseline of the project activity is determined in accordance with the methodology AMS I.D of Appendix B of Simplified modalities and procedures for small scale CDM project activities.

The baseline scenario of this project is: electricity delivered to the Peninsular Malaysia 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. Therefore, in accordance with AMS I.D. the baseline of the project is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) of the national grid calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'(version 02)[3];

OR

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The project activity produces electricity from a renewable source and supplies to a grid which is supplied by several fossil fuel based sources. The grid is Peninsular grid of TNB where about 90.34 % of the

[3] "Tool to calculate the emission factor for an electricity system" that used in the proposed project is based on version 1.1 at the time of first submission of Project Design Document to the DOE. The report "Study on Grid-connected Electricity Baselines in Malaysia Year 2005" that conducted by Pusat Tenaga Malaysia was based on the version 1.1 of the approved "Tool to calculate the emission factor for an electricity system".

installed capacity is fuelled by fossil fuels and only 9.66% is from Renewable energy, mainly hydro (9.6%) and mini hydro (0.06%).[4]. Refer to Annex 3 for fuel generation mix in Peninsular Malaysia.

Therefore, as per AMS ID, the baseline for the project activity is the kWh produced by the project activity multiplied by the emission factor of the grid calculated by one of the two methods as mentioned above.

The baseline emission factor used in this project was based on the report "Study on Grid-connected Electricity Baselines in Malaysia Year 2005[5] conducted by Pusat Tenaga Malaysia. The data used for the calculations originated from official sources; therefore the result of the study was made available (http://cdm.eib.org.my/). This study used the CDM Executive Board approved methodologies of ACM0002 of the "Consolidated Baseline Methodology for Grid connected Electricity Generation from Renewable Sources" for large scale projects and the AMS 1.D for the small scale projects. This approved methodology can be applied to grid-connected electricity generation projects that use renewable sources. Both the methodologies use the approved 'Tool to calculate the emission factor for an electricity system'; applicable to grid-connected electricity generation projects that use renewable sources.

Information about the baseline emission factor is given in Annex 3- Baseline information.

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 small-scale CDM project activity:

Justification for application of simplified methodologies to the project activity

The installed capacity of the project is 4.2MW, which is less than the limiting capacity of 15MW and its thus eligible to use small scale simplified methodology. Further, the project activity is generation of electricity of grid system using hydro potential. Therefore, the type and category of the project activity matches with I.D. as specified in Appendix B of the indicative simplified baseline and monitoring methodologies for small scale CDM project activities

Justification for additionality of the project activity

In accordance with Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, a qualitative analysis demonstrating that the project activity would not occurred anyway due to at least one of the following barriers:

(a) Investment barrier;
(b) Technological barrier;
(c) Barrier due to prevailing practice;
(d) Other barriers.

The additionality of the proposed project is demonstrated and assessed by the investment barrier analysis.

[4] National Energy Balance 2007, Ministry of Energy, Water and Communication, Table 9, pg 29.

[5] Study on Grid-connected Electricity Baselines in Malaysia Year 2005 (Printed January 2008) conducted by Pusat Tenaga Malaysia.

Investment barrier

National Grid, Malaysia is the primary electricity transmission network linking the electricity generation, transmission, distribution and consumption in Malaysia. It is operated and owned by Tenaga Nasional Berhad (TNB). Power generated by Tenaga Nasional and independent power producers is carried by the National Grid towards customers connected to the various distribution networks.

The proposed project is a small scale hydropower project. Due to the small installed capacity and low project IRR, the proposed project faces the obvious investment barrier. The calculation and analysis of financial indicators of the proposed project are as follows:

Alternative: The proposed project activity not undertaken as a CDM project activity.

The Government of Malaysia has set a target of 350MW of new grid connected electricity generation capacity for renewable energy sources by the end of 2010 in the 9th Malaysia Plan[6]. Table B.3 below lists the status of Small Renewable Energy Projects (SREP) implementation in Malaysia, as of December 2007.

The table B.3 below shows 9 renewable projects licensed to generate total of 80.9MW of electricity; and in year 2007, only 2 projects are delivering power to the grid. The remaining of the projects is still not commissioned.

Table B.3 - Active Renewable Energy Power Producers 2007[7]

No.	SCORE license approved	Type of plant	Licensed Capacity (MW)	Energy Source	Units Generated (GWh)	Units Sold (GWh)
1	Bumibiopower Sdn. Bhd.	Steam Turbine	6	Empty Fruit Bunch	*	*
2	Jana Landfill Sdn. Bhd.	Gas Turbine	2	Landfill Gas	4,104	4,104
3	TSH Bio Energy Sdn. Bhd.	Steam Turbine	14	Waste from Palm Oil	66,552	49,563
4	Potensi Gaya Sdn. Bhd.	Steam Turbine	7	Empty Fruit Bunch	*	*
5	Alaf Ekspresi Sdn. Bhd.	Steam Turbine	8	Waste from Palm Oil	*	*
6	Naluri Ventures Sdn. Bhd.	Steam Turbine	12	Waste from Palm Oil	*	*
7	Seguntor Bioenergy Sdn. Bhd.	Steam Turbine	11.5	Empty Fruit Bunch	*	*
8	Kina Biopower	Steam	11.5	Empty Fruit Bunch	*	*

[6] 9th Malaysia Plan 2006 – 2010, Economic Planning Unit, Prime Ministers Department, 2006 : Pg 408, Section 19.46.

[7] Energy Supply Industry in Malaysia, Performance and Statistical Information 2007, Malaysian Energy Commission, pg 97. http://www.st.gov.my/images/stories/upload/st/st_files/public/Report_Performance.pdf

	Sdn. Bhd;	Turbines				
9	Recycle Energy Sdn. Bhd.	Steam Turbines	8.9	Refuse Derived Fuel	*	*

**Not in operation or not performing*

From the table B.3 above, it is very clear that the Small Renewable Energy Power Program (SREP) has failed to deliver significant volumes of electricity generated in Peninsular Malaysia. One of the main barriers in implementation of renewable energy is the financial barrier that incorporates the following[9]:

1. Tariff offered by the National Utility (TNB) not meeting market IRR expectations;
2. Lack of financing; and
3. Certain provisions in Renewable Energy Power Purchase Agreement (REPPA) unacceptable to SREP developers.

Tariff offered by TNB are insufficient to make the SREP projects viable. The cost of planning, site study, surveying, designing, developing and construction of this project is intensive whilst the electricity selling price is low. The selling price of energy to the national utility is fixed at 16.7 sens /kWh for the next 21 years, according to Renewable Energy Power Purchase Agreement (REPPA) offered by TNB to AMDB Perting Hydro Sdn. Bhd.[10] Thus, the revenue generated from the selling of electricity to the national utility (TNB) alone does not generate attractive returns and the payback period for the project is too long.

The initial financial decision for Sungai Perting Mini hydro was conducted in late 2005 using the Bank Pembangunan Malaysia Berhad Renewable Energy loan product. The initial potential income from CER's were estimated based on the presentation titled "Presentation of CDM Baseline" by Malaysian Energy Centre dated October 2003[11] . However, the grid emission factor used in this PDD is based on the latest available figure from the "Study on Grid-connected Electricity Baselines in Malaysia Year 2005[12] (Published January 2008) conducted by Pusat Tenaga Malaysia, Malaysian Energy Center.

The interest rate offered at that time was the Banks effective cost of funds plus a spread of up to 2.5%[13]. The banks' effective cost of funds in late 2005 was 6.2%. [14] . This would make the benchmark for the project at **8.7%.**

The Project IRR was calculated as per latest "Guidance on the Assessment of Investment Analysis - version 02.1" of CDM EB 41. The internal rate of return of the project activity was calculated for 23

[9] Erik Dugstad et al 2007: Options for implementation of the RE target in 9th Malaysia Plan. Page 3 Summary Downloaded from www.eib.ptm.org.my

[10] REPPA(Renewable Energy Power Purchase Agreement) between AMDB Perting Hydro Sdn. Bhd. and Tenega National Berhad

[11] Power Point slides on "presentation of CDM baseline" by Malaysian Energy Centre (Pusat Tenaga Malaysia) , October 2003.

[12] Study on Grid-connected Electricity Baselines in Malaysia Year 2005 (Printed January 2008) conducted by Pusat Tenaga Malaysia.

[13] Bank Pembangunan product brochure for renewable energy and CDM. Pg. 3, (e).

[14] Bank Negara Malaysia report on "Statutory requirements" Published 22nd March 2006, Table 1.2, pg 15 of 366

years (2 year construction period + 21 years operation period) which is also the term of Power Purchase Agreement . The Project IRR is calculated to be 8.21 % for 23 years.
It may be seen that the returns from the project activity from the sale of electricity alone are very low. This IRR is lower than the borrowing rate for the project which is 8.7 %. The latest Guidance on the Assessment of Investment analysis suggests that commercial borrowing rate to be one of the benchmarks for Project IRRs[15]. This is a very conservative benchmark as the rate of returns expected are generally higher than the lending rates. The project activity would not be able to even service the debt component of the project with sale of electricity to the grid. In spite of Government' initiative to promote renewable energy, there has been a reluctance on the part of the electric utility to offer better prices to facilitate establishment of such projects on a commercial scale as the purchase price offered by the electric utility does not make the projects commercially viable.

There are various risk associated with the project as follows :

1) Shareholder equity/advances to make up 24% of the capital. The shareholders would expect returns to their investment
2) Delay in construction & Capital cost overrun
3) Short fall in water flow / lower production of electricity.
4) Possibility of higher O & M costs in the future.
5) Risk of any potential new legislation, relating to environment or the process of a mini-hydro plant e.g. industry restructuring, in the future that will result in a possible increase in capital expenditure of O & M costs.

The project IRR without CDM incentives for Perting mini Hydro is only 8.21**%** which deems to be financially unattractive and made it difficult to obtain financing from the banks.

The basic parameters for evaluating the financial status of the project are listed in Table B.4 below.

Table B.4: Key parameters for financial analysis

Parameters	**Value**	**Data Resource**
Installed capacity (MW) Net Export Capacity (MW)	4.2 4.0	Technology Providers Specification
Annual power supplied to grid (MWh)	28,032	Based on 80% Load factor
Total investment (RM million)	31.5	Project financial model
Electricity tariff (RM/kWh)	0.167	REPPA[16]
Budgeted CER price (Euro/tCO_2e) throughout Kyoto commitment period (Until end 2012)	10	ERPA[17]
Budgeted CER price (Euro/tCO_2e) post Kyoto commitment period (2013 onwards)	7	World Bank Report

[15] Guidance 11 of "Version 02.1- Guidance on Investment Analysis, EB 41 Annex 45"

[16] REPPA – Renewable Energy Power Purchase Agreement Offer letter by Tenaga National Berhad to AMDB Perting Hydro dated 22nd April 2006, *(Ref No: TNB(B)/HEKO/PSTK 9/1/33)*

[17] Emission Reduction Purchase Agreement between CER buyer and Project Proponent.

Operation period (years)	21	
Water royalty tax to state government	2.2% of total power sales to TNB	Based on approval by UPEN[18]
Annual O&M Cost (RM '000 / yr)	753	Project financial model with annual escalation cost at 5%.

Table B.5: Comparative table of the financial indicators with or without CER's income

Financial indicator	Without CDM	With CDM
Project IRR 23 Years (Before Tax)	8.21%	10.58 %

As observed from Table B.5 , registration of the project activity as a CDM project activity is critical to ensure a commercially reasonable return of 10.58%.

Sensitivity Analysis

A sensitivity analysis was also conducted to assess whether under reasonable variations in the critical assumptions, the results of the analysis remain unaltered. Variations of ±10% have been considered in the critical assumptions, the result of which is depicted in the table below:

Table B.6: Result of sensitivity analysis

Variables	23 Years IRR
Total Investment reduced by 10%	9.58 %
Electricity Tariff increased by 10% (to 18.37 cents/kWh)	9.88 %
Net Electricity Generation increased by 10%	9.88%
Annual O&M Cost reduced by 10%	8.61%
Base case	8.21%

There is theoretical possibility of exceeding the benchmark IRR caused by the variation of total investment, tariff or annual operating hour, however, the practical possibility of each variation is discussed in the table below.

[18] UPEN – Unit Perancang Ekonomi Negeri (State Economic Planning Unit) – Ref No: Bil (13) dlm SUK.PHG.(UPEN) 7792.Sj. 674 Pt.2, Dated 30th May 2005

Table B.7: Practical Possibility assessment of critical factors

<table>
<tr><td>Variation range and assessment factor</td><td>Practical assessment of the practical factors.</td></tr>
<tr><td>Total investment</td><td>When total investment of project decrease, the IRR will increase.
The IRR calculation in based on letter of award to the suppliers for the main equipments such as the turbines and piping that make up almost 70% of the total CAPEX. No clauses exist in the contract for reduction of contract value; therefore it is very unlikely the total CAPEX will be reduced.

Also, as there is no change in the component of total investment, the total investment of project is mainly subject to the industrial product price indices, which indirectly follows the country’s inflation rate. Table B.8.1 below shows inflation rate in Malaysia for 2006, 2006 & 2008.

<table><tr><th>Inflation Rate (%)</th><th>2006</th><th>2007[19]</th><th>2008[20]</th></tr><tr><td>CPI</td><td>3.6</td><td>2.0</td><td>5.4</td></tr><tr><td>Core CPR</td><td>2.1</td><td>1.8</td><td>4.0</td></tr></table>Table B.8.1 ; Average inflation Rate for Malaysia

The table above clearly shows the Consumer Price Index increase more than two folds from 2007 to 2008. Therefore, based on the escalation cost of construction and project components, it is highly unlikely the total investment of project will decrease more that 10% thus increasing</td></tr>
<tr><td>Electricity Tariff</td><td>When the electricity tariff increases, the IRR will also increase.
With a 10% increase in electricity tariff to 18.37cents /kwh, there projects meets the internal benchmark criteria.
However, increase in electricity tariff is not possible. As per the Renewable Energy Power Purchase Agreement, the tariff is fixed for the next 21 years with a clause of no change.
Thus the 10% increase in electricity tariff is unlikely to occur.</td></tr>
<tr><td>Electricity Generation increase by 10%</td><td>When the electricity generation increases, the IRR will also increase.
Also, as per clause 5.1, a (ii) of the REPPA, The quantity of net electrical energy generated in one complete year will not exceed 28,032,000kWh. Any energy exceeding the additional energy delivered to TNB will be delivered to TNB at no cost. Therefore, even if this mini hydro could produce excess energy, it will not generate any excess revenue to the company.</td></tr>
<tr><td>Annual Operating and Maintenance cost</td><td>IRR for the project would achieve benchmark only when the operating and maintenance cost is reduced by 50%, which is impossible in practice.</td></tr>
</table>

[19] Bank Negara Malaysia Annual Report 2007, Press Release , Page 4

[20] Bank Negara Malaysia Annual Report 2008, Press Release, page 3

Based on the above results, the IRR of the project activity, are in general below 8.7%, which is also below the standard return in the market for independent power producers. These results also support the conclusion that the project activity is unlikely to be financially attractive without CDM registration.
It must be mentioned here that the commercial borrowing rate is a very conservative benchmark as the project IRR calculations used the bank lending rate as the benchmark, and it is very unlikely that investors would invest in the project with expectations to get returns as only that of commercial borrowing rates.

As explained above, the CDM would improve the IRR to the level above the commercial lending rate making the project viable. Thus CDM would alleviate the barriers that exist for the proposed project activity and that would prevent the proposed project activity from occurring.

The above barrier clearly shows that considerable investment barriers exist for the project activity. The project activity as already explained would reduce GHG Emissions by displacing grid electricity by renewable source of energy. Therefore, it may be concluded that the project activity is additional.

CDM Consideration Process.
The crediting period will start after the project is registered. CDM revenue was considered from the early stages of the project's development, and it is an integral part of the financial package of the project.

Table B.7 : CDM Consideration

Initial inquiry on CDM process correspondence letter to Pusat Tenaga Malaysia	13/05/2005[21]
Approval from state government	30/05/2005[22]
1st Financial evaluation of project	20/09/2005[23]
Rejection letter from Bumiputra commerce bank dated 13 October 2005 as a reason for difficulty in getting financing.	13/10/2005[24]
Negotiations ongoing with finance institutions for financial aid and TNB for the Power purchase agreement.	2006
Renewable Energy Power Purchase Agreement Signed.	29/11/2006[25]
Site clearance for access road to power intake and power house	12/2006 – 04/2007
1st Concrete poured on site based on progress report to TNB	26/4/07[26]

[21] Letter of CDM inquiry from AMDB to Malaysian Energy Centre, dated 13th May 2005.

[22] Pahang State Approval on the Proposal of mini hydro Project at Sungai Perting dated 30th May, 2005. (Ref No: Bil (13) dlm.SUK.PHG.(UPEN) 7792)

[23] Based on internal memo dated 20th Sept 2005 and supported by Bank Pembangunan Brochure on facilities available for renewable energy, 2005.

[24] Rejection letter from Bumiputra commerce bank dated 13 October 2005 as a reason for difficulty in getting financing.

[25] REPPA Agreement signed between AMDB Perting Hydro Sdn.Bhd and Tenaga National Berhad (TNB)

Change of Management (Project was put on hold) Stop Work order given to contractor to immediately stop all services in relation to the project	May 07 – Sept 07[27] 2/07/2007[28]
Start work order to Civil contractor for the mini hydro project	15/10/2007[29]
CDM Agreement finalized and signed with CDM consultant, SV Carbon Sdn. Bhd.	3/03/2008[30]
Validation agreement with TUV-Rheinland Japan Ltd	25/09/2008[31]

Activity	**Started**	**Completed**	**Percentage**
Preliminaries: Site Possession	01-02-07	01-02-07	100%
Main Intake Structure:	14-05-07	09-09-07	100%
Settling Tank:	30-05-07	20 – 05-08	100%
Intake Mechanical Equipment:	02-07-07	20-11-08	100%
Penstock, Saddles, Crossing and Anchoring Blocks	27-08-07	29-10-07	100%
Power House	25-05-08	03-12-08	100%
Turbine and Generator:			
Factory Acceptant Test	17-07-08	18-07-08	100%
Delivery to Site (Sg. Perting)	26-11-08	06-12-08	100%
Mechanical Installation of Turbine and Generator Unit 1	06-12-08	13-01-09	100%
Mechanical Installation of Turbine and Generator Unit 2	06-12-08	13-01-09	100%
Wiring of Turbines, Generators, Transformers, Switchgears and Control Panel	23-01-09	13-02-09	100%
Testing and Commissioning	02-10-09	12-10-09	100%
Transmission Line			

[26] Letter from AMDB Perting Hydro Sdn. Bhd. to Tenaga National Berhad informing commencement of project dated 27th April 2007, (Ref No. amdbpwr/ptghy/corresp_tnb270407)

[27] Announcement of AMDB Berhad become the subsidiary of AMCORP Group Berhad dated on 14th June, 2007 and the appointment of CEO on 30th July, 2007 (Source: Bursa Malaysia Website).

[28] Package A construction stop work order to civil contractor dated 2nd July 2007, (Ref No. PTGHY/002GN/010707(2)

[29] Package A construction start work order to civil contractor dated 15th Oct 2007, (Ref No. PTGHY/002GN/151007(3)

[30] CDM contract signed between AMDB Perting Hydro Sdn.Bhd. and SV Carbon Sdn.Bhd.

[31] Validation agreement signed with TUV-Rheinland

Laying and jointing of underground cable	18-07-08	26-12-08	100%
Laying and jointing of Ariel Bundle Cable (ABC)	23-12-08	24-12-08	100%
Extension of SSU Kg. Baru / Switchgear	23-12-08	12-02-09	100%
Installation of Switchgear and Metering Panel	13-06-09	12-10-09	100%

Table B.8 : Work progress and completion status of the hydro project at time of PDD submission for registration.

Impact of CDM revenues to the project activity

The approval and registration of the AMDB Perting Mini Hydro Project as a CDM project activity will assist the project to overcome the associated and related barriers as discussed above in implementation and completion of the project activity; and other company(ies) in Malaysia that decides to embark on to the similar project activity in the future.

The benefits arising from successful implementation, completion and registration of the project activity as a CDM project activity by the CDM Executive Board are as follows:

- The project activity will reduce anthropogenic greenhouse emissions by generating electricity supply via clean energy source;
- The income derived from the sale of CERs to Annex 1 party will assist to overcome the investment barriers as demonstrated above, and the additional revenue from the sale of CERs will also act as a provision in the event of any unexpected breakdowns; and
- The investment cost involved for the development of small hydro project is considerably high. In general, this poses difficulties for companies to embark on similar project as AMDB Perting Mini Hydro Project without the project being registered as a CDM project activity.

Therefore, the proposed project activity is additional and not (part of) the baseline scenario as it overcomes the barriers discussed above and can reduce the greenhouse gas emissions.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The proposed project activity meets the requirements of the simplified baseline methodology category AMS I.D. as discussed earlier in Section B.2. Therefore, in accordance with paragraph 10 of the methodology, the baseline of the project is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) of the national grid calculated in a transparent and conservative manner as:

Calculation of Emission reduction

ER_y	=	BE_y	-	PE_y	-	PL_y
(ton CO_2 e/year)		(ton CO_2 e/year)		(ton CO_2 e/year)		(ton CO_2 e/year)

Where,

ER_y	-	Emission reduction per annum by project activity in ton CO_2 e/year
BE_y	-	Baseline emissions in ton CO_2 e/year
PE_y	-	Project emissions in ton CO_2 e/year
PL_y	-	Leakage in ton CO_2 e/year

Calculation of Baseline Emissions *(BE_y)*

The Baseline Emissions (BE_y) are calculated by multiplying the Baseline Emission Factor (EF_y) by annual power generation i.e.:

$$BE_y = (EG_y - EG_{baseline}) \cdot EF_y$$

Where:

BE_y	the baseline emissions in year *y*;
EG_y	the electricity supplied by the project activity to the grid;
$EG_{baseline}$	the baseline electricity supplied to the grid in the case of modified or retrofit facilities; and
EF_y	the emission factor in year *y*

As the project involves the construction of a new hydropower station, $EG_{baseline}$ is zero and the formula can be simplified as:

$$BE_y = EG_y \times EF_y$$

Project Emission ($PE_{,y}$)

The project activity uses a diesel generator during start up of the project activity. The emissions due to diesel consumption by the project activity would be accounted as project emissions. This is expected to happen only during start up of the project activity. After commissioning the project activity, the diesel required to run the installations in the hydro power plant would be powered by the project itself.[32]

The project Emission due to consumption of diesel is considered "zero" as the diesel usage is negligible. However, diesel usage will be monitored and is included in the monitoring plan in section B.7.1

$$PE_{,y} = FY_c \times EF_{diesel} \times \rho_{diesel}$$

Where

PE_y	is the project emissions due to electricity consumed from diesel usage in ton CO_2e/year
FY_c	project diesel fuel consumption in year y (l)
EF_{diesel}	CO_2 emission coefficient for diesel, kgCO_2 / kg diesel (As per AMS I.D version 15)
ρ_{diesel}	Diesel Density (kg/l)

[32] Letter from ABDB to Tenaga Nasional Berhad dated 6 March 2009 for the installation of 1 unit of reverse power relay which will only allow electricity to flow in one direction to ensure that no electricity is imported from the grid. (Ref no, PTGHY/005TNB/060309 (10))

As the project is a run-off river hydro project and it is not implemented in an existing or new reservoir, the project emissions from water reservoirs of hydro power plants ($PE_{HP,y}$) due to the area of submergence are not considered.

Leakage

Leakage due to transfer of equipment

As per Para 15 of AMS I.D / Version 15, leakage is to be considered only "if the energy generating equipment is transferred from another activity". Since this does not apply for the project activity, there is no leakage associated with the project activity and therefore, leakage is zero.

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

Data / Parameter:	**Generation Mix**
Data unit:	GWh
Description:	Annual electricity generation in TNB by power sources (2001 – 2005)
Source of data used:	Study on Grid connected Electricity Baselines in Malaysia, prepared by CDM Energy Secretariat, Pusat Tenaga Malaysia (PTM-Malaysian Energy Centre), for 2005, published in January , 2008, for small scale projects
Value applied:	Please refer annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	To be used to demonstrate the applied condition of Simple OM that 'the average electricity generated by low-cost/must-run power sources over the past 5 years is less than 50 % of total electricity generation of the grid'.
Any comment:	

Data / Parameter:	**CEF_{GRID}**
Data unit:	tCO_2e/MWh
Description:	Baseline emission factor for the Peninsular Malaysia Grid
Source of data used:	Study on Grid connected Electricity Baselines in Malaysia, prepared by CDM Energy Secretariat, Pusat Tenaga Malaysia (PTM-Malaysian Energy Centre), for 2005, published in January , 2008, for small scale projects
Value applied:	0.62
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is required to estimate the emission reductions. CDM Energy Secretariat of PTM is the official agency of DNA and has been publishing the grid emission factor and has been periodically reviewing it. The emission factor has been revised as late as January, 2008
Any comment:	

Data / Parameter:	**Installed Capacity**
Data unit:	MW
Description:	Installed Capacity of the mini hydro power plant

Source of data used:	Technical Specification of equipment from turbine and generator supplier. [33]
Value applied:	4.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is taken directly from the manufacturers specification
Any comment:	

Data / Parameter:	**Annual Operation Hours**
Data unit:	Hr/yr
Description:	Estimated operation hours of the project activity
Source of data used:	Sungai Perting Hydrological Data
Value applied:	7,008
Justification of the choice of data or description of measurement methods and procedures actually applied :	Only 80% of the total flow capacity of the Sungai Perting river is used for power production in the mini hydro power plant based on the flow duration curve in the hydrological data of Sungai Perting
Any comment:	

Data / Parameter:	**CEF_{diesel}**
Data unit:	$kgCO_2$ / kg diesel
Description:	CO_2 emission coefficient for diesel
Source of data used:	As per AMS I.D Version 15 following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories)
Value applied:	3.20
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	ρ_{diesel}
Data unit:	Kg / l diesel
Description:	Diesel density
Source of data used:	As per diesel Material Safety Data Sheet by Caltex Oil Malaysia Ltd.
Value applied:	0.85
Justification of the choice of data or	Diesel density is used to calculate baseline emission from on-site diesel consumption.

[33] Technical Specification of Equipments from Technology Provider.

description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

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

$ER_y = BE_y - PE_y - L_y$

Baseline emissions

The ex-ante baseline emissions of the project activity are calculated as per following formula:

BE_y = EG_{el} x EF_B

(ton CO_2 e/year) (MWh /year) (ton CO_2e /MWh)

Where,

BE_y - Baseline emissions in ton CO_2e /year

EG_{el} - Net electricity exported to grid per annum in MWh/year

EF_B - Baseline emission factor in ton CO_2e /MWh

The estimated net electricity supplied to the grid is estimated as follows:

Net electricity export per year = 4.0 MW

The plant capacity is expected to operate at 80%[34] utilisation factor

Net electricity exported = 4.0 MW * 8760 hours/ year * 0.80

= 28,032 MWh/ year

The baseline emission factor of the grid is 0.62 t CO2e /MWh. For calculation in the PDD, ex-ante grid emission factor is used based on "Tool to Calculate the Emission Factor for the Electricity System'(Version 02).

Applying these values in the formula for baseline emissions,

BE_1 = 28,032 * 0. 62 = 17,380 tCO_2e/yr

(ton CO_2 e/year) (MWh /year) (ton CO_2 e /MWh)

Project Emission

The project activity would use diesel generator set during start up to run the electrical installations in the hydro power plant. The project Emission is considered "zero" as the diesel usage is almost negligent. However, diesel usage will be monitored and is included the monitoring plan in section B.7.1

PEy = **0 tCO_2/yr**

[34] Flow duration curve of the project activity submitted to DOE

Emission Reductions

Ex-ante emission reductions by the project activity are estimated by the following formula:

ER_y = BE_y - PE_y

(ton CO_2 e/year) (ton CO_2 e/year) (ton CO_2 e/year)

= 17,380 tCO_2 e/year - 0tCO_2/yr

= 17,380 t CO_2 e/year

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

Table B.11: Overall Emission reductions

Year	Estimation of project emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emissions reductions (tCO_2e)
Year 1	0	**17,380**	0	**17,380**
Year 2	0	**17,380**	0	**17,380**
Year 3	0	**17,380**	0	**17,380**
Year 4	0	**17,380**	0	**17,380**
Year 5	0	**17,380**	0	**17,380**
Year 6	0	**17,380**	0	**17,380**
Year 7	0	**17,380**	0	**17,380**
Total (tonnes of CO_2e)	**0**	**121,660**	**0**	**121,660**

The start date of the crediting period will be the day the project is registered by the UNFCCC

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

B.7.1 Data and parameters monitored:	
Data / Parameter:	**EG_y**
Data unit:	kWh
Description:	Electricity supplied by the project activity to TNB Grid
Source of data to be used:	Direct reading from the kWh meter
Value of data applied for ex-ante estimates	28,032 (based on 80% load factor of the 4MW net generation capacity of the mini hydro plant)
Description of measurement methods and procedures to be applied:	The measurement will be from an energy meter continuously measuring the transport of electricity. The project owner will record the kWh supply of electricity to the grid system monthly. The readings will follow the same periods as the billing period in the Renewable Energy Power Purchase Agreement (REPPA) under which electricity is supplied to the grid, meaning that the readings will be for each calendar month. According to the REPPA the project proponent will keep records on electricity supply to the grid system, properly stored and maintained at its offices at the site, for a minimum of seven years and for such additional time period as may be required by law or by Government authority having jurisdiction over the project owner and project activity.
QA/QC procedures to be applied:	The project owner and the electricity company i.e. TNB will jointly read the main metering equipment at the Interconnection Point within five Business Days after the end of each calendar month. The meter will be calibrated as per manufacturer's standard.
Any comment:	The data for power sales are part of a commercial agreement with the power company and will thus be cross checked by the parties to the REPPA.

Data / Parameter:	**V_{diesel}**
Data unit:	Litre
Description:	Volume of diesel used on site
Source of data to be used:	Diesel Purchase Bills
Value of data	Based on usage.
Description of measurement methods and procedures to be applied:	Purchase bills for diesel used in the generator set will be used for total amount of diesel combusted in the back up generator set.
QA/QC procedures to be applied:	The purchase bill will be crossed checked with the total operating hours of the generator set and amount of power supplied to the hydro plant.
Any comment:	

B.7.2 Description of the monitoring plan:

In accordance with the small-scale methodology AMS I.D. the monitoring shall consist of metering the electricity generated by the renewable technology.

This monitoring plan will set out a number of monitoring tasks in order to ensure that all aspects of projected greenhouse gas (GHG) emission reductions for the proposed project are controlled and reported.

This requires an on-going monitoring of the project activity to ensure performance according to its design and that claimed Certified Emission Reductions (CERs) are actually achieved.

The monitoring plan of the proposed project is a guidance document that provides the set of procedures for preparing key project indicators, tracking and monitoring the impacts of the proposed project. The monitoring plan will be used throughout the defined crediting period for the project to determine and provide documentation of GHG emission impacts from the proposed project. This monitoring plan fulfils the requirement set out by the Kyoto Protocol that emission reductions projects under the CDM have real, measurable and long-term benefits and that the reductions in emissions are additional to any that would occur in the absence of the certified project activity.

Key definitions
The monitoring plan will use the following definitions of monitoring and verification.

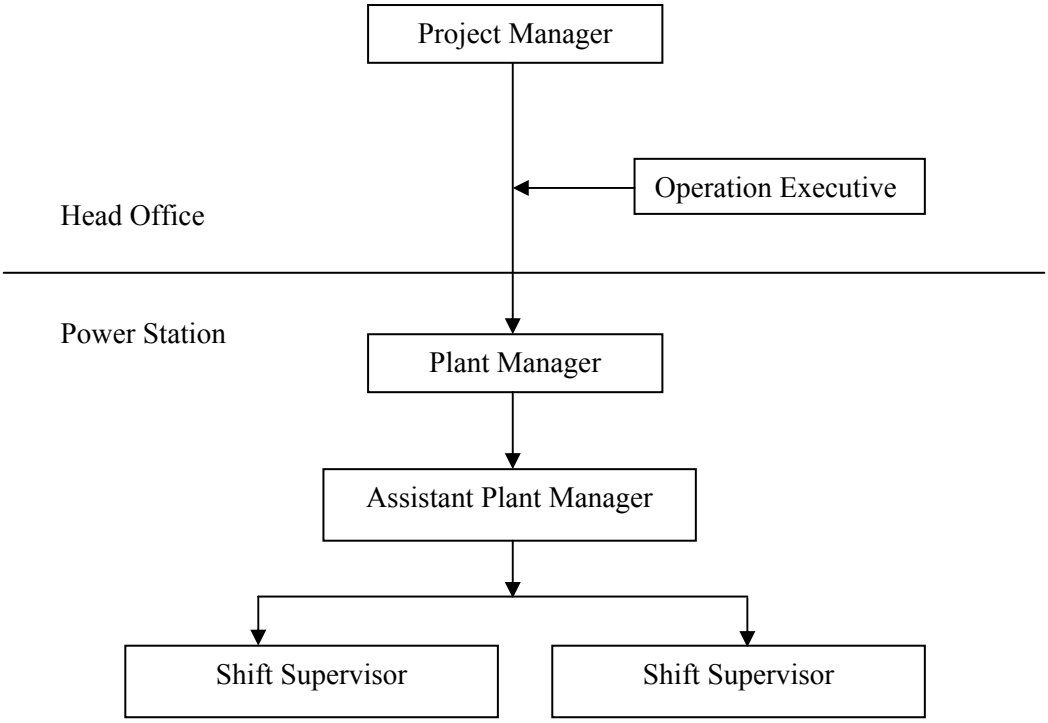
Monitoring: The systematic surveillance of the project's performance by measuring and recording of performance-related indicators relevant in the context of GHG emission reductions.

Verification: The periodic ex-post auditing of monitoring results, the assessment of achieved emission reductions and of the project's continued conformance with all relevant project criteria by a selected DOE.

The monitoring plan provides the requirements and instructions for:

1. Establishing and maintaining the appropriate monitoring systems for electricity generated by the project;
2. Quality control of the measurements;
3. Procedures for the periodic calculation of GHG emission reductions;
4. Assigning monitoring responsibilities to personnel;
5. Data storage and filing system;
6. Preparing for the requirements of an independent, third party auditor or verifier.

Figure B.2: Management structure to monitor emission reductions



Roles and Responsibility

1. Project Manager
Confirming the values and data summarized by Operation Executive and verifying them with data from the Plant Manager for the issuance of CER.

2. Operation Manager
Data collection from the Plant Manager, storing, filing and preparation of reports on the amount of emission reductions achieved.

3. Plant Manager
Overall management of the implementation of the monitoring plan and quality control of data and records. To calculate emission reductions based on the monthly summry and advise Project Manager on the amount achieved.

4. Assistant Plant Manager
In charge of the monitoring of electricity meters and calibration and recording the power generation data from the meters.

5. Shift Supervisor
Overall in charge of recording any down time and maintenance work to the power plant

Calibration of meters & metering
The metering equipment will be properly calibrated and checked every 24 months. TNB Metering Department will conduct the calibration of the kWh meters and also the Current Transformers.

Monitoring
The proposed project activity adopts the ex-ante calculation of emission factor of the grid; thus only the electricity supplied by the project activity to the grid (EG_y) needs to be monitored during the crediting period.

According to REPPA entered into between the project proponent and TNB, the project proponent keep records on electricity supply to the grid system, properly stored and maintained at its offices at the site, for a minimum of seven years and for such additional time period as may be required by law or by Government authority having jurisdiction over the project proponent and project activity.

The project proponent and the electricity company i.e. TNB will jointly read the main metering equipment at the interconnection point within five business days after the end of each calendar month. A back-up meter (also called as Check Energy Meter) is installed for the proposed project which records the electricity exported and allows readings to be taken. In the event of main metering equipment is failed, the back-up meter will be used. (Figure B.3)

Quality assurance and quality control
The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity. This is an on-going process that will be ensured through the CDM in terms of the need for verification of the emissions on an annual basis according to this PDD.

Data management system
This provides information on record keeping of the data collected during monitoring. Record keeping is the most important exercise in relation to the monitoring process. Without accurate and efficient record keeping, project emission reductions cannot be verified. All data recorded will be archived for a period of two years after the crediting period.

Below follows an outline of how project related records would be managed;

1. Overall responsibility for monitoring of GHG emissions reduction will rest with the CDM responsible person of the project activity. Procedures for tracking information from the primary source to the end-data calculations in paper document format will be continuously enhanced.

2. It is the responsibility of the project proponent to provide additional necessary data and information for validation and verification requirements of respective DOE.

3. Physical documentation such as paper-based maps, diagrams and environmental assessment will be collated in a central place, together with this monitoring plan. All paper-based information will be stored by the project proponent and kept at least one copy.

Verification of monitoring results
The verification of monitoring results of the project activity is a mandatory process required for all CDM project activities. The main objective of the verification is to independently verify that the project activity has achieved the emission reductions as reported and projected in the PDD. It is expected that the verification will be done annually.

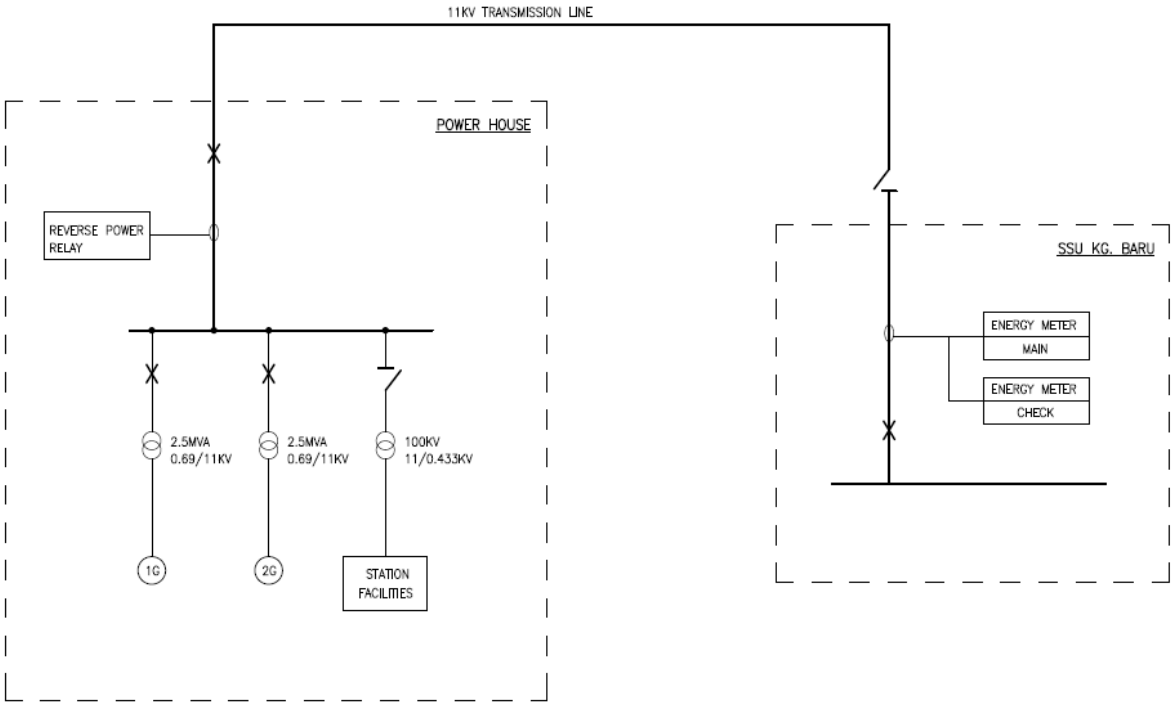
All archived monitoring data, required for verification and issuance, will be kept for at least two years after the end of the crediting period or the last issuance of CER. Data archived will also be verified regularly by the DOE. The performance of the project activity will be reviewed and analyzed by the consultant on a regular basis.

Emergency Preparedness Plan

The operational staff's main task is to keep a close watch on a day to day basis on the functioning of the major equipment. The operating staff would also document the downtime and operating hours for each turbine along with the reasons for the downtime. The operating staff would summarize the logbook data on a monthly basis and provide the same to the head office.

The project Proponent will also deploy maintenance staff at the plant to ensure minimal breakdown of the major equipment. Additionally, it will ensure supply of sufficient quantity of critical and essential spares and consumables for the requirement of the machines. These critical and essential spares and consumables shall be stocked at the project site to reduce the machine repair downtime. A complete set of tools and tackles will be maintained at the site at the project site. The site in-charge together with the staff would ensure that periodic maintenance checks are performed on all major components.

Figure B.3 – Grid Connection Diagram



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

Date of completion of baseline study:
12/05/2008

Name of person(s)/entity (ies) determining the baseline:
Mr. Ilango Bharathi[35]
Deputy CEO
YTL-SV Carbon Sdn. Bhd. [36]
ilango@ytl.com.my

Office:
YTL-SV Carbon Sdn. Bhd.
Level 4, Annex Block
Lot 10 Shopping Centre
50, Jalan Sultan Ismail
50250 Kuala Lumpur,
Malaysia

Phone : + (6) 03 – 2144 7200
Fax : + (6) 03 – 2144 7573
Hand phone : + (6) 019 262 7970
Url : www.ytl-svcarbon.com

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:

27/4/07[37]
Start date of the project is based on the first day concrete was poured at site.[38]

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

The expected operational lifetime of the project is 21 years, which is the electricity purchase agreement entered with the electricity distribution company.

[35] The consultant is NOT a project participant

[36] The entity is NOT a project participant

[37] Letter from AMDB Perting Hydro Sdn. Bhd. to Tenaga National Berhad informing commencement of project dated 27th April 2007, (Ref No. amdbpwr/ptghy/corresp_tnb270407)

[38] Letter of information to Tenaga National Berhad on the first pouring of concrete at site dated 27/4/07

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

The project will adopt renewable crediting period.

C.2.1. Renewable crediting period

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

01/ 12 /2010 or on the date of registration whichever occurs later
(The crediting period will only start after the project is registered).

C.2.1.2. Length of the first crediting period:

7 Years

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. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

According to the Malaysian regulations, renewable energy projects are not required to prepare an Environmental Impact Assessment (EIA). This has been confirmed by the Malaysian Department of Environment (DOE)[39]. Thus, no EIA has been prepared.

The project activity must comply with the environmental regulations of the country and obtain the necessary approvals before commissioning and during operation of the project. The project developer has submitted the Environmental Management Plan (EMP) of the proposed project activity to the Pahang State DOE and the approval letter was received from the state DOE approving the EMP.[40] Summary of the mitigation measures proposed by the project proponent in the EMP to minimise environmental effects due to the project activity are:

(i) The project will be implemented using "run-of-river" concept without the needs for reservoir as conventional dam;

[39] Confirmation letter from Malaysian Department of Environment stating that EIA is not needed for this project, dated 19th December 2008, (Ref No: C38/310/200/002(21)

[40] Acceptance letter of Environmental Management Plan (EMP) from Malaysian Department of Environment dated 21st Nov 2006. *(Ref No. AS.C 38/310/200/002(17))*

(ii) Mitigation measures to minimise soil erosion:

a. Implement construction works by stages;
b. Commence immediate turfing/hydro seeding works on exposed land/slide;
c. Build silt trap at the identified areas

(iii) Water Quality Control:

a. Conduct water quality monitoring;
b. The report on the water quality monitoring to be submitted to the Pahang state DOE on a monthly basis;
c. Project implementation schedule to be streamlined with the mitigation measures to ensure effective environmental conservation.

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 and the Environmental Management Plan (EMP) by the project proponent was accepted and approved by the state Department of Environment.

SECTION E. Stakeholders' comments

>>

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

>>

A stakeholder meeting was held for the above project on 27th June 2008 at the local council office in the district of Bentong, Pahang, Malaysia. The representatives were mainly from the local council, village head, project consultant and developer. AMDB made a request to Forestry Department, to allocate a time in the meeting for the CDM presentation. The Forestry Department then made a request to the Chairman of the meeting to slot in AMDB stakeholder presentation. Upon agreement by the Chairman, the CDM presentation became part of the meeting agenda. The participants were informed via letters/memos. The invitees were followed up with calls to confirm attendance. The meeting was attended by 35 participants.

The following is a breakdown of the attendance at the meeting:

Department/Organisation	*Representatives*
District Officer & Assistant	4
Member of Parliament	1
Member of Local Council	3
Government Department	17
Head of Local Villages	4
Water Works Department (JBA)	1

Department/Organisation	*Representatives*
TNB staffs	1
Consultants	2
AMDB Staff	2
TOTAL	**35**

Table E.1: Stakeholder attendance list

Presentation

Opening speech was presented by Mr. Badrul Hisham Hamdan, Deputy General Manager, AMDB Perting Hydro Sdn. Bhd. He briefed participants on the intention of the stakeholder meeting and to in-corporate Clean Development Mechanism (CDM) into the mini hydro project.

Mr. Badrul Hisham then proceeded to explain in more detail AMDB Perting Hydro Sdn. Bhd.'s background and implementation phases of the hydro project.

Ms. Bhavna introduced participants to the Clean Development Mechanism as one of the mechanisms to address the reduction of greenhouse gas emissions to atmosphere. She informed effects and consequences of global warming. She also explained advantages of CDM projects, types of CDM projects implemented in Malaysia and how it is supported by the Malaysian government under the sustainable development project.

E.2. Summary of the comments received:

The following issues were raised by the participants. They were addressed by Mr. Badrul Hisham Hamdan and Ms. Bhavna Khandar.

1. **Mr. Toantowee Bin Mohd. Lotfie, District Officer, Bentong**

   How this mini hydro project is related to the CDM and is it under the United Nations?

   The mini hydro produces power using renewable energy instead of burning of fossil fuel, thus reducing green house gas emission from conventional methods of power production.
   The project is under United Nations Framework Convention on Climate Change (UNFCCC) program.
   It is in line with Malaysia's commitment to produce 350MW power from renewable energy in the 9th Malaysian Plan.

2. **Dato' Hoh Khai Mun, local Council Member, Bilut, Bentong.**

   What is the project implementation method? What is the impact of the project to the Chamang waterfalls as it is an important picnic area for locals and tourists?

AMDB Perting Hydro had briefed the local council in detail the project activity and implementation stages in their last meeting held in April 2008. The project is now 70% completed and will commission sometime in November 2008.
Continuous water sample is sent to the Department of Environment under the approved Environmental Plan.
The recreation area of the Chamang Waterfalls will not be affected as all works pertaining the river is completed. The only works pending now is the construction of the power house.

3. **Downstream to the river is a water catchment area used for drinking water. How can you ensure traces of oil will not enter the water?**

The mini hydro project does not use any oil. It is run of river concept.

4. **Zaliza Binti Zanil, Assistant Manager, Tenaga National Berhad, Bentong**

During the cable laying process, part of the cable that supplies electricity to a village was damaged and caused a commotion at the village. You need to survey your cable laying works more stringently.

During the cable laying work, when cable trench was being dug by the excavator, it accidentally damaged an underground cable that supplied electricity to the orang asli (native) village. The cable was not marked as per regulation and no one knew of the existence on the cable in that area. The fault was remedied and the village got the power back within one day.
En. Badrul apologized for the incident and ensured more stringent methods will be taken so as not to disturbed nearby villagers.

5. **Muhamad Fadzil Bin Harris, Manager, Alam Flora Sdn. Bhd.**

Could you please explain potential CDM projects for landfill gas extraction in municipal waste disposal?

There are currently 2 registered projects for landfill gas extraction for the purpose of power generation. One at Seelong Sanitary landfill and the other at Krubong Melaka LFG Collection & Energy Recovery. There is one project in Selangor running the past three years generating power for local consumption.

6. **Mr. Toantowee Bin Mohd. Lotfie, District Officer, Bentong**

When the project is ready and implemented, who will oversee the maintenance and monitoring on regular basis?

The REPPA (Renewable Energy Power Purchase Agreement) is signed for 21 years. Under the agreement, AMDB Perting Hydro Sdn. Bhd. is responsible for the maintenance and monitoring of the project.
After 21 years, the contract will be reviewed. If it is continued, AMDB Perting Hydro will continue the maintenance, otherwise the project will not run if there are no buyers for the power generated.

7. **Mr. Toantowee Bin Mohd. Lotfie, District Officer, Bentong**

   What happens if there is a national blackout. Will the mini hydro still able to supply power to Bentong town?

   The supply from this project is only 4 MW and the Bentong town needs about 20MW. Therefore, the power will be used only for high priority premises such as the hospital. However, that is not under the jurisdiction of AMDB Perting Hydro. Power is only supplied up to the TNB substation. The distribution of power from that point onwards is under the jurisdiction of TNB.

8. **En. Nazaruddin Bin Ahmad, Pelangai Village Head, Bentong**

   Why can't other existing hydro projects claim for CDM now?

   Under the UNFCCC guideline, only new or expansion to the existing hydro project will be accepted.

Mr. Toantowee Bin Mohd. Lotfie, the District Officer of Bentong thanked Mr. Badrul Hisham and Ms. Bhavna Khandhar for the mini hydro and CDM project briefing. The CDM concept is new for many of us. We would like to request for a tour to the project site once it is completed.

The meeting was adjourned at 11.30 am and participants were informed that they could also submit questions on the project to AMDB Perting Hydro Sdn. Bhd. office within a week.

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

Participants did not raise any objections to the project and demonstrated a keen interest in its environmental and social impacts.

The AMDB Perting Hydro office did not receive any questions or queries on the project one week after the stakeholder meeting.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	AMDB Perting Hydro Sdn Bhd
Street/P.O.Box:	L2-77, Level 2, Business Suite Menara Melawangi
Building:	No 18, Jalan Persiaran Barat
City:	Petaling Jaya
State/Region:	Selangor Darul Ehsan
Postfix/ZIP:	46050
Country:	Malaysia
Telephone:	+603 7966 2699
FAX:	+603 7966 2698
E-Mail:	
URL:	www.amdbgroup.com
Represented by:	
Title:	Deputy General Manager
Salutation:	Mr.
Last Name:	Hamdan
Middle Name:	Hisham
First Name:	Badrul
Department:	Engineering
Mobile:	
Direct FAX:	+(6) 03-7966 2698
Direct tel:	+(6) 03 – 7966 2659
Personal E-Mail:	badrulhisham@amdbgroup.com

Organization:	EnergiMidt Handel A/S
Street/P.O.Box:	Tietgensvej 2-4
Building:	
City:	Silkeborg
State/Region:	
Postfix/ZIP:	DK - 8600
Country:	Denmark
Telephone:	+ 45 7015 1560
FAX:	+ 45 76 58 1124
E-Mail:	
URL:	www.energimidt.dk
Represented by:	
Title:	Mr.
Salutation:	Head of Trading
Last Name:	Griem
Middle Name:	
First Name:	John
Department:	Trading
Mobile:	+ 45 3092 4019
Direct FAX:	+ 457658 1111

Direct tel:	+ 45 7658 1121
Personal E-Mail:	jkg@energimidt.dk

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project does not receive any public funding from Annex 1 Parties.

Annex 3

BASELINE INFORMATION

See calculations in Section B.6

As per paragraph 11 of AMS I.D., the baseline emission factor has to be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in "tool to calculate the emission factor for an electricity system" (version 02).

(OR)

Table A-- The weighted average emissions (in kg CO_2e/ kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Identification of the applicable grid system for the project activity

The electricity grid network of Malaysia has following grids:

1. Peninsular grid
2. East Coast Sabah grid
3. West Coast Sabah grid
4. Sarawak grid

The project activity supplies electricity to the Peninsular grid of Malaysia. At present, all grids are independent and are not interconnected. There is no export or import of electricity among the grids. The Peninsular grid is largest of them and is totally independent from other grids. Therefore, Peninsular grid is chosen as the applicable grid system for the project activity.

The installed capacity of the Peninsular grid is about 91 %[41] of total installed capacity of Malaysia. All other grids constitute for only 9 % of the total capacity. Therefore, it is justified to use the simple operating margin to calculate the grid emission factor for the Peninsular Grid.

The installed capacity of fuel mix in Peninsular grid as of 31 December, 2007 is given in Table Annex 3 below:

[41] Source: National Energy Balance, Malaysia, 2007f

Table Annex 3 -1 : Fuel mix in Peninsular grid[42]

Fuel Mix	TNB	IPP	Total	Percent
	MW	MW	MW	%
Steam				
Coal	2070	3,700	5,770	28.8
Gas	240	600	840	4.2
Combined cycle	2762	6058	8,820	44.0
Gas turbine			0	
Diesel	68		68	0.3
Gas	1365	1240	2,605	13.0
Hydro	1911	20	1,931	9.6
Mini Hydro	13		13	0.06
Total	**8,429**	**11,618**	**20,047**	**100**

From the table above, it is noted that of the total fuel mix in the Peninsular Grid, 90.34% is fossil fuel based and only 9.66% is from Renewable energy, mainly hydro (9.6%) and mini hydro (0.06%).

Grid emission factor

The grid emission factor for each grid is calculated and published by CDM Energy Secretariat of Pusat Tenaga Malaysia (PTM) (Malaysia Energy Centre) as "Study on Grid Connected Electricity Baselines, Malaysia, " (hereinafter referred to as "Baseline study") and the latest Study was published in January, 2008.

PTM is the official agency of DNA, Malaysia and has been involved in approval of CDM projects and capacity building for CDM in Malaysia.

AMS I.D suggests to estimate the emission factor of the grid by two approaches:

a) Combined Margin Method as per Tool to calculate the emission factor for an electricity system and
b) The weighted average emissions (in kg CO_2e/ kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

[42] National Energy Balance 2007, Ministry of Energy, Water and Communication, Table 9, pg 29.

Table Annex 3-2 - Electricity Generation from Fossil Fuel Vs Hydro for Peninsular Malaysia[43]

Generation Mix	Year				
	2001	**2002**	**2003**	**2004**	**2005**
Thermal (GWh)	63,442	62,854	67,511	77,566	82,605
Hydro (GWh)	4,992	4,444	4,032	4,985	4,188
Total	**68,434**	**67,298**	**71,543**	**82,551**	**86,793**
Average percentage of thermal generation	**93.99 %**				
Average percentage of low cost (hydro) generation	**6.01%**				

Since the average of low cost generation for the last 5 years is less than 50 %, simple operating margin has been considered in the calculation of emission factor

The Baseline study by PTM, Malaysia has estimated the emission factor for small scale projects as **0.620 ton CO_2 e / MWh[44]:**

[43] Study on Grid Connected Electricity Baselines, Malaysia, January, 2008.

[44] The Baseline Study mentions that the emission factor has been calculated as per ACM0002. It must be noted that the steps specified in ACM0002 to estimate the emission factor are same as in "Tool to calculate the emission factor for an electricity system – Version1.1. The Baseline study had adopted the latest IPCC 2006 Guidelines for National Greenhouse Gas Inventories to estimate the emission factor. Therefore, it may be considered that the emission factor has been calculated as per the tool.

Annex 4

MONITORING INFORMATION

See the Monitoring Plan in Section B.7