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

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

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Bintulu Combined-Cycle Project STG Unit No.9, Tanjung Kidurong, Bintulu, Sarawak
CDM-PDD Version 1,
April 11, 2008

A.2. Description of the project activity:

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Description of the project activity

Sarawak Power Generation Sdn. Bhd. (SPG) intends to covert the existing two (2) open-cycle gas turbine generating sets (GTG-7 and GTG-8) in the Bintulu Power Station to one (1) block of Combined-Cycle Power Generation Plant at Block 20, Kemena Land District, Tanjung Kidurong, Bintulu, Sarawak with a new total capacity of about 330 MW. (New generation is only 110.37 MW)

The basic scope of this project is for one (1) complete steam turbine generating plant (designated as STG-9) comprising the retrofitting of the two (2) existing 106.68 MW rated GTG-7 and GTG-8 gas turbine generating sets each with a heat recovery steam generator (HRSG) and one (1) steam turbine generating set in a 2:2:1 configuration. The proposed steam turbine generating set is to export the power produced to Syarikat SESCO Berhad (SESCO) EHV network by connecting directly to SESCO 275 kV indoor gas insulated switchgear (GIS) substation at Bintulu Power Station.

With this combined cycle technology, the new facility is able to generate about 30% more electricity from its fuel (natural gas) than it would with a conventional open-cycle power system. It is estimated that the upgrading towards the combined cycle technology will increase the existing generating capacity of about 220 MW to 330 MW that would be able to cater for the supply to more industries in the near future.

Contribution to Sustainable Development

With the fast development within the state and the improved networks of roads and other infrastructure in recent years, the electricity demand throughout Sarawak especially in the fast growing smaller towns is expected to be on the rise.

Sarawak Energy Berhad (SEB) intended to increase power supply to factories and smelting companies. The Sarawak State Government also aims to bolster economic growth to an average of 6.1% a year in 2006 through 2010.

Therefore, the setting up of a new combined-cycle power generation plant in Bintulu is an imperative move which will support Sarawak Government's aim and help Sarawak Energy to reduce its generation cost and thus cut its reliance on costlier fuels such as diesel and gas.

The project will contribute to sustainable development by providing a modern and efficient combined-cycle technology that will help meet Sarawak's increasing energy demand in a more sustainable manner. The project will enable the additional production of electricity with the same amount of fossil fuels, thus increasing the efficiency of power generation. In addition, the proposed Combined-Cycle Gas Turbine

conversion is the first in Sarawak. The CCGT project will increase the skilled workforce required at the generating station. The CCGT will result in training of local workers.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	If the Party involved wishes to be considered as project participant (Yes/No)
Malaysia (host)	Sarawak Power Generation	No
Japan	Mitsubishi Corporation	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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Malaysia

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

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Sarawak

A.4.1.3. City/Town/Community etc.:

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Bintulu

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

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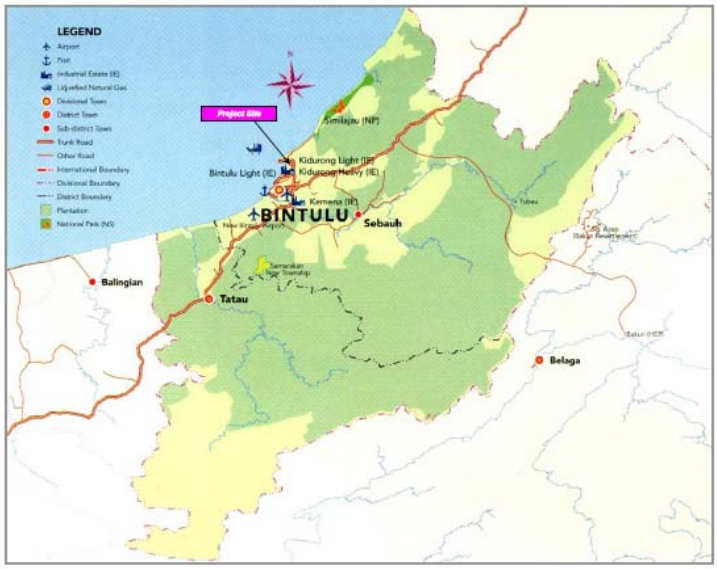
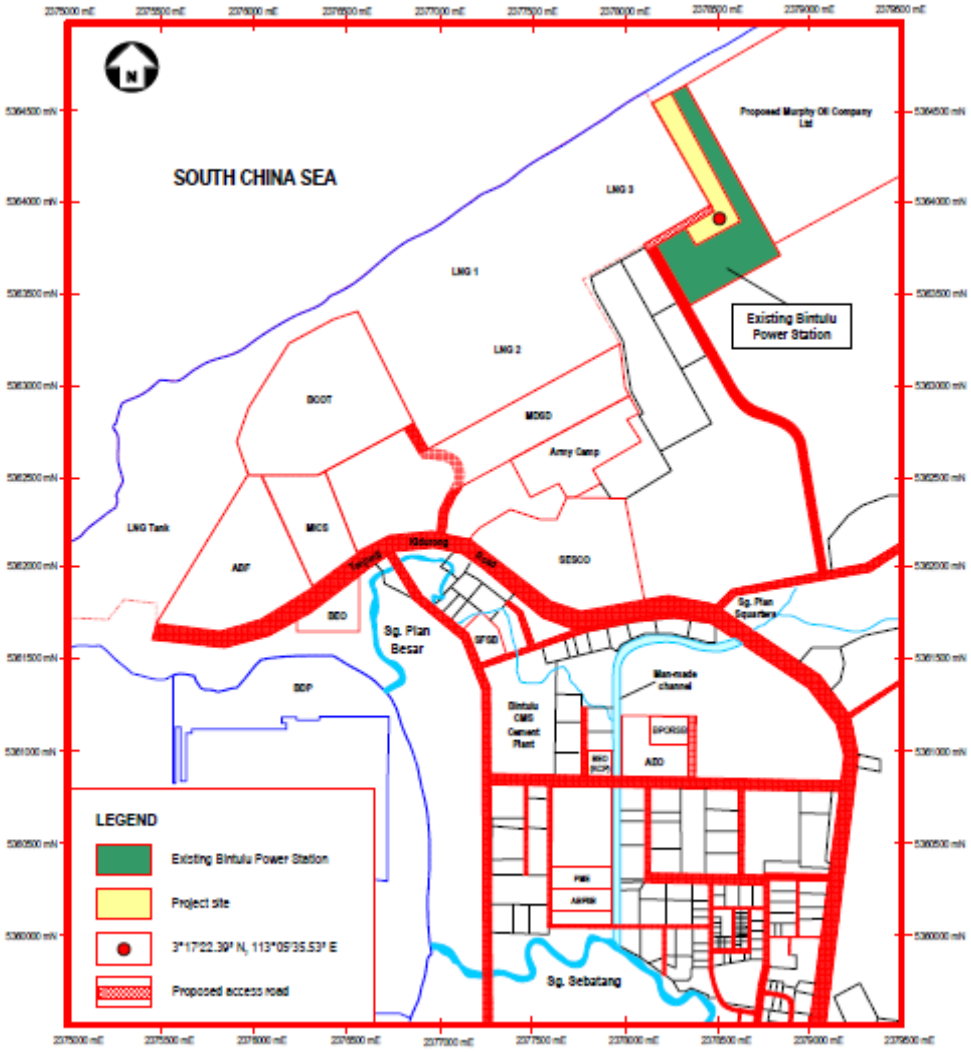
The Project site is located in Tanjung Kidurong Industrial Zone, Bintulu Division, Sarawak. It is accessible through Tanjung Kidurong Road and overlooking the South China Sea. The proposed plant is adjacent to the existing unit GTG-7 and GTG-8 power plant at Block 20, Kemena Land District, Tanjung Kidurong, Bintulu, Sarawak (3º17'22.39"N, 113º05'35.53"E). Refer to the general map and Project location map as shown below.




SOUTH CHINA SEA
Proposed Murphy Oil Company Ltd
LNG 3
LNG 1
LNG 2
Existing Bintulu Power Station
BOOT
MDKD
Army Camp
LNG Tank
MICS
ADF
SEDCO
BEO
Sg. Plan Besar
SFGB
Sg. Plan Squarters
BDP
Man-made channel
Bintulu CMS Cement Plant
ADO
Sg. Sebatang
LEGEND
Existing Bintulu Power Station
Project site
3°17'22.39" N, 113°05'35.53" E
Proposed access road

Aerial view of Bintulu Power Station and Combine-cycle Project Location

Existing Gas Turbine Generator Sets

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

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Sectoral Scope I: Energy industries (renewable - / non-renewable sources)

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

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The project activity coverts the existing two (2) open-cycle gas turbine generating sets (GTG-7 and GTG-8) to one (1) block of Combined-Cycle Power Generation Plant with a new total capacity of about 330 MW. (New generation is only 110.37 MW)

The basic scope of this project is for one (1) complete steam turbine generating plant (designated as STG-9) comprising the retrofitting of the two (2) existing 106.68 MW rated GTG-7 and GTG-8 gas turbine generating sets each with a heat recovery steam generator (HRSG) and one (1) steam turbine generating set in a 2:2:1 configuration. The proposed steam turbine generating set is to export the power produced to Syarikat SESCO Berhad (SESCO) EHV network by connecting directly to SESCO 275 kV indoor gas insulated switchgear (GIS) substation at Bintulu Power Station.

With this combined cycle technology, the new facility is able to generate about 50% more electricity from its fuel (natural gas) than it would with a conventional open-cycle power system. It is estimated that the upgrading towards the combined cycle technology will increase the existing generating capacity of about 220 MW to 330 MW that would be able to cater for the supply to more industries in the near future.

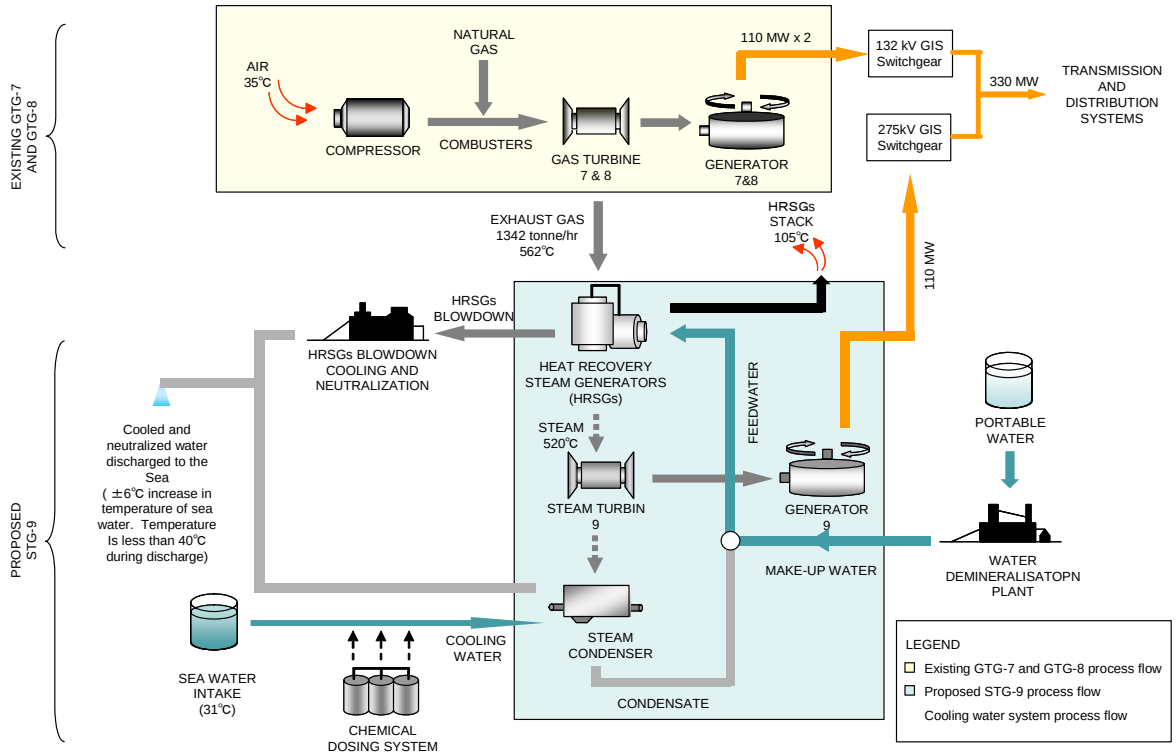

Figure: Overall Process Flow Chart of Proposed Bintulu Combined Cycle Power Plant

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
2009	278,824
2010	669,177
2011	669,177
2012	669,177
2013	669,177
2014	669,177
2015	669,177
2016	390,354
Total estimated reductions (tonnes of CO_2e)	4,684,240
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	669,177

A.4.5. Public funding of the project activity:

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There is no public funding involved in the proposed 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 project activity:

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Approved consolidated baseline methodology ACM0007: "Baseline methodology for conversion from open cycle to combined cycle power generation" (Version 03, Sectoral Scope 01)

Methodological Tool: "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 02.1)

Methodological Tool: "Tool to calculate the emission factor for an electricity system" (Version 01)

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

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ACM0007

This methodology is applicable:

	Applicability of ACM0007	Proposed project activity
1	When project developers utilize previously-unused waste heat from a power plant, with a single-cycle capacity, be it a gas turbine or an internal combustion engine and utilize the heat to produce steam for a turbine – thus making the system combined-cycle;	The project activity generates electricity with waste heat released in the operation of gas turbines running in open cycle and uses it to produce steam for another turbine. As is shown by Operation and Maintenance Manual for the existing open cycle gas turbine, no equipment for heat recovery had been / is installed.
2	When waste heat generated on site is not utilizable for any other purpose on-site;	There are some factories in the Tanjung Kidurong Industrial Zone, but the project participants do not know what they are doing and what kind of heat they need. If there are factories which have heat demand, they will cater for their heat by installing their own boilers. Therefore, there is no other use for the waste heat.
3	Where the project activity does not increase the lifetime of the existing gas turbine or engine during the crediting period (i.e. this methodology is applicable up to the end of the lifetime of existing gas turbine or engine, if shorter than crediting period);	The project activity neither increases nor decreases the expected life of the existing gas turbines because the project activity does not change any systems of the gas turbines. The project activity uses the waste heat from the existing gas turbines.

		The existing gas turbines have been installed in 1999 and expected lifetimes are 25 years. The gas turbines are expected to operate to well beyond the crediting period.
4	Where project developers have access to appropriate data to estimate the combined margin emission factor, as described in the "Tool to calculate the emission factor for an electricity system", of the electricity grid to which the proposed project is connected.	The Sarawak Power Generation has access to the appropriate data since PTM (Pusat Tenaga Malaysia), Malaysia has conducted a baseline study in January, 2008.

All applicability requirements for these methodologies are met by this project.

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

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For the purpose of determining GHG emissions of the **project activity**, the following emissions sources are included:

- CO2 emissions from on-site fuel consumption of fossil fuels for operation of the gas turbine; and

In the project activity, there is no on-site fuel consumption, to supplement the waste heat generated from gas turbine, in generating steam to operate the steam turbine.

For the purpose of determining the **baseline**, the following emission sources are included:

- CO2 emissions from fossil fuel fired power plants connected to the electricity system and in the operating and build margin;
- CO2 emissions from operation of project power plant in open cycle mode.

The spatial extent of the project boundary encompasses the power plant at the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The spatial extent of the of the project electricity system, including issues related to the calculation of the build margin (BM) and operating margin (OM), is as per that defined in "Tool to calculate the emission factor for an electricity system".

The following table illustrates which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

Table: Overview on emissions sources included in or excluded from the project boundary

	Source	Gas		Justification / Explanation
Baseline Scenario	Baseline: Grid electricity generation	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	On-site fossil fuel consumption to operate project power plant in open cycle mode.	CO_2	Included	An important emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
Project Activity	On-site fossil fuel consumption to operate the gas turbine of project power plant.	CO_2	Included	An important emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

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

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The latest approved version of the "Combined tool to identify the baseline scenario and demonstrate additionality" agreed by the CDM Executive Board, is used to identify the most plausible baseline scenario and demonstrate additionality.

STEP 1. Identification of alternative scenarios

This step serves to identify all alternative scenarios to the proposed CDM project activity(s) that can be the baseline scenario through the following sub-steps:

Sub-step 1a. Define alternative scenarios to the proposed CDM project activity

Alternative scenarios that are available to the project participants and that provide outputs or services with comparable quality, properties and application areas as the proposed CDM project activity are identified here. These alternative scenarios include:

1. The proposed project activity undertaken without being registered as a CDM project activity;
2. Continuation of current practice, i.e. power is generated and supplied to the grid from the existing gas turbines running in open cycle configuration, from other grid-connected power plants, and potentially by the addition of new generation sources to the grid
3. Construction of a new open cycle gas-fired power plant to increase the output of the Bintulu power station
4. Construction of a new coal-fired power plant

The construction of a new hydro power plant is not considered because the construction period of a new hydro power plant is about five years, which is much longer time than that of the proposed project activity.

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

In this Sub-step 1b, alternative 1, 2, 3 and 4 are reviewed against the mandatory applicable laws and regulations.

The following regulations, which ACM0007 requires project participants to take into account when evaluating the identified alternative baseline scenarios for their compliance with applicable regulations in the framework of the Combined Tool, are not considered because there are no such regulations in Malaysia.

• Regulations for utilization of waste heat on the premises where it is generated;
• Regulation on energy efficiency norms for power projects; and
• Emission norms for power projects.

After the review, all four alternatives are in compliance with the regulations. Therefore, there is no regulatory requirement that would prevent the implementation of the four alternatives.

STEP 2. Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. Apply the following sub-steps:

Sub-step 2a. Identify barriers that would prevent the implementation of alternative scenarios:

Barriers to Alternative 3 "Construction of a new open cycle gas-fired power plant to increase the output of the Bintulu power station":

Alternative 3 has prohibitive barriers. At present, PETRONAS, through its joint venture company, Malaysia LNG Sdn. Bhd., produces liquefied natural gas (LNG) for export market. Its three integrated natural gas plants within the PETRONAS LNG Complex in Bintulu, Sarawak have a total capacity of 23 million tonnes per annum (mtpa). The Complex is now world's largest LNG production facility at a single location. The LNG is sold to Japan, Taiwan and Korea for the power, industrial and residential sectors. With this increase demand overseas, PETRONAS is reluctant to sell natural gas to the Sarawak Power Generation. Therefore, alternative scenario 3 cannot be considered as the baseline scenario since it faces prohibitive barriers.

Barriers to Alternative 4 "Construction of a new coal-fired power plant":
There are some coal reserves in Sarawak, but most of the coal is considerably low quality. The development of coal takes longer and impacts the environment. The difficulty of obtaining the coal prohibits the construction of a new coal fired power plant. Therefore, alternative scenario 4 cannot be considered as the baseline scenario since it faces prohibitive barriers.

Sub-step 2b. Eliminate alternative scenarios which are prevented by the identified barriers:

As described above, there are two remaining scenarios, alternative scenario 1 and 2, which are plausible and does not face any prohibitive barriers.

Since there are still two alternative scenarios remaining, including the proposed project activity undertaken without being registered as a CDM project activity, Step 3 Investment analysis was conducted.

STEP 3. Investment analysis

The table below represents the main information used in the Equity IRR calculation for the Project activity. Details of the equity IRR calculation are submitted to the DOE during validation.

Item	Value
Initial investment costs	365,000,000 RM
Amount of bank loan (out of initial investment costs)	292,000,000 RM
Electricity tariff	0.070 RM/kWh
Electricity generation(696,141,000 kWh)	48,730,000 RM/yr
O&M costs/yr	9,800,000 RM/yr
Project life (The current purchase agreement on natural gas is expired in 2023, and after 2023 it is uncertain whether the current agreement can be extended or not.)	17 years
Income tax rate	25 %
Equity IRR (after tax, without CERs)	-1.05 %
Equity IRR (after tax, with CERs)	13.89 %

Initially, Sarawak Power Generation plan to finance from the Parent Company, Sarawak Energy, through a revolving credit facility at 0.5% above banks cost of capital. Final financing will be through raising of a SUKUK bond fund.

The latest cost of capital of the latest power project, the Mukah Coal Fired Power Plant, is between 7%-8%, as shown at the Bank Negara (National/Federal Bank) website.
https://fast.bnm.gov.my/fastweb/public/PublicInfoServlet.do?chkBox=200600000156&mode=DISPLAY&info=FACILITY&screenId=PB030800

The IRR of the project activity without the additional income from CDM is -1.05% and is far below the interest rate, at which Sarawak Power Generation plans to finance. This indicates that the Project is not financially viable without CDM assistance. With the additional income from CERs sales, the equity IRR of the project activity increases to 13.89%.

Sensitivity analysis

The following scenarios are established and analyzed to examine whether the conclusion regarding the financial attractiveness of the Project is robust.

1) Changes in the initial investment costs from –10% to 0%
2) Changes in electricity tariff from 0% to +10%
3) Changes in O&M costs from –10% to 0%

Electricity generation was not considered for sensitivity analysis because the electricity generation of combined cycle is fairly stable.

Following table shows the result of the sensitivity analysis for each scenario. It is impossible for initial investment costs and O&M costs to be cut down by over 10%, because the construction fee, labour cost, materials price etc. are increasing by inflation. Electricity tariff of 0.070 RM/kWh is the lower end and it is unlikely to be higher than 0.080 RM/kWh.

	-10%	-5%	0	5%	10%
Initial investment costs	3.28%	1.09%	-1.05%		
Electricity tariff			-1.05%	1.5%	3.8%
O&M costs	0.02%	-0.51%	-1.05%		

Even applying the most favourable conditions for each scenario, Equity IRRs of the project activity are still below the cost of capital, which confirms the fact that the project activity is unlikely to be financially attractive and successful implementation is dependent on CDM assistance.

Therefore, the investment into the project activity without the additional income from CDM cannot be justified. Alternative scenario 1 can not be considered as a baseline scenario.

Thus, the baseline scenario is Alternative 2, i.e. “Continuation of current practice, i.e. power is generated and supplied to the grid from the existing gas turbines running in open cycle configuration, from other grid-connected power plants, and potentially by the addition of new generation sources to the grid”.

STEP 4. Common practice analysis

The previous steps are complemented with an analysis of the extent to which the proposed project type has already diffused in the Sarawak Power Grid. This test is a credibility check to demonstrate additionality which complements the barrier analysis (Step 2) and the investment analysis (Step 3).

There are several open cycle power plants in Sarawak, but the conversion from open-cycle to combined cycle is the first of its kind in Sarawak.

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):

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Additionality was demonstrated in B.4, using the latest approved version of the "Combined tool to identify the baseline scenario and demonstrate additionality".

As the per "Specific guideline for completing the Project Design Document (CDM-PDD)", it is required to provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the Project activity since the starting data of the Project activity is before the date of validation.

The proposed project activity is not economically attractive without the additional revenue from CERs sales. Approached by Mitsubishi Corporation, Sarawak Power Generation has recognized that the project activity is highly eligible for a CDM project activity and can gain additional income from CERs sales. With the confidence that the project activity can gain additional income from CDM assistance, the Board meeting of Sarawak Power Generation decided to proceed with procurement of equipment in project activity in September 7th, 2007. The Board Resolution is to be provided to DOE during the validation process.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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In accordance with the ACM0007 version 3, the project activity mainly reduces CO2 emissions through substitution of power generation supplied by the existing generation sources connected to the grid and likely future additions to the grid. The emission reduction (ERy) by the project activity during year y is the difference between the baseline emissions (BEy), project emissions (PEy) and emissions due to leakage (Ly), and can be expressed as follows:

$ER_y = BE_y - PE_y - L_y$

Where:

ER_y The emissions reductions due to the project activity during the year *y* in tons of CO_2

BE_y The baseline emissions due to displacement of electricity during the year *y* in tons of CO_2

PE_y The project emissions during the year *y* in tons of CO_2

L_y The leakage emissions during the year *y* in tons of CO_2

Project Emission (PE_y)

Project emissions (PE_y) include emissions from the use of fossil fuel to operate the gas turbine ($PEGT_y$). There is no emission from the use of supplementary fossil fuel used in order to operate the steam turbine.

$PE_y = PEGT_y$

$PEGT_y = \Sigma_i (FGT_{i,y} * NCV_i * EF_{CO2,i})$

where:

FGTi,y The amount of fuel i (in a mass or volume unit) consumed to operate the gas turbine by the project in year y.

NCV The net calorific value (energy content) per mass or volume unit of the fuel used.

$EFCO_2$ The CO_2 emission factor per unit of energy of the fuel used.

Baseline emissions (BEy)

The baseline scenario is the following: electricity would be generated by the operation of the power plant in open cycle mode, and by grid-connected power plants. The baseline emissions for year *y* (with assumption made regarding the baseline situation) are calculated as follows:

$BE_{X,y} = (EF_{OC} * OG_{X,y}) + (EF_{grid,y} * (PG_y - OG_{X,y}))$

where:

EF_{OC} Emission factor for plant operational in Open Cycle Mode in tCO_2/MWh.

$OG_{X,y}$ Electricity generated by the open cycle in the baseline (in MWh); as shown below, this is calculated in two ways based on historical data ($OG_{H,y}$), or based on the load factor in the project plant ($OG_{P,y}$) and Index X is either "H" or "P".

PG_y Actual electricity generated by project in year y (MWh)

EF_{grid} The CO_2 emission factor for the electricity displaced due to the project activity during the year y in tones tCO_2/MWh.

Step 1: Estimating $OG_{X,y}$

The amount of generation by the power plant running in open cycle mode in the baseline (in MWh) is estimated by the two ways provided below. The calculation is done based on (i.) the historic load situation (OGH,y) and for (ii.) the load situation in the project (OGP,y), as follows:

(i.) Amount of baseline power generation assuming on historical data (in MWh):

$OG_{H,y} = HG_{OC}$

Where:

HG_{OC} The average net annual generation from the operation of power plant in open cycle mode based on five years of generation records previous to start of the project (in MWh).

(ii.) Amount of baseline power generation calculated assuming load situation of project power plant (in MWh):

$OG_{P,y} = OC / PC * PG_y$

Where:

OC The net power generation capacity of the open cycle gas turbine (before the project activity) in MW

PG_y Actual electricity generated by project in year y (MWh)

PC Net installed power generation capacity (MW) of the project including both the open cycle (gas turbine) plus the steam turbine capacity

Step 2: Estimating EF_{OC}, the emissions factor for electricity generated in open cycle mode in the

baseline

The emissions factor for the open cycle mode generation in the baseline (EF_{OC} in tCO2/MWh) is given by historical performance of the plant when it operated in open cycle using data for 5 years previous to the start of project. The emission factor is calculated as follows:

$EF_{OC} = FC_{HIST} / HG_{OC,x} * NCV * EFCO_2$

Where:

FC_{HIST} Annual average fuel consummation of the open cycle gas turbine (in mass of volume units) estimated using data for five years previous to start of the project

$HG_{OC,x}$ The average net annual generation from the operation of power plant in open cycle mode based on 'x' years of generation records previous to start of the project (in MWh)

NCV The net calorific value (energy content) per mass or volume unit of the fuel

$EFCO_2$ The CO_2 emission factor per unit of energy of the fuel

Step 3: Determine the emissions factor for the operating margin

The Baseline emission factor (EF_y) is calculated as a combined margin (CM), following the guidance in the "Tool to calculate the emission factor for an electricity system".

Step 4: Conservatively determine baseline emissions

The baseline emission BE_y for year y is the lower value between the baseline emissions calculated on the basis of historical power generation, $BE_{H,y}$, and the baseline emissions calculated based on the load factor of the project situation, $BE_{P,y}$:

$BE_y = MIN (BE_{H,y}, BE_{P,y})$

Leakage

The main emissions potentially giving rise to leakage in the context of the proposed projects are:

(i) CH_4 leakage in production, transportation and consumption of increased quantity of natural gas consumed by the project activity; and
(ii) Emissions arising due to power plant construction.

The CH4 emissions can be ignored because it is demonstrated these are a negligible fraction of baseline.

According to the ACM0007 version 3, project participants do not need to consider construction related emission sources as leakage.

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

Data / Parameter:	5. HG_{OC}
Data unit:	MWh/year
Description:	Historical Net quantity of electricity generated by the Open Cycle operation of power plant.
Source of data used:	Historical data
Value applied:	1,216,149.80
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is average electricity generation for five years (2003-2007). 2003: 933,310.00; 2004: 1,209,080.00; 2005: 1,250,071.00; 2006: 1,303,948.00; 2007: 1,384,340.00
Any comment:	

Data / Parameter:	8. FC_{HIST}
Data unit:	Nm3/year
Description:	Historic Fuel consumption of the project in Open cycle generation.
Source of data used:	Historical data
Value applied:	403,077,159.60
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is average fuel consumption for five years (2003-2007). 2003: 305,489,050.00; 2004: 403,826,433.70; 2005: 417,315,574.03; 2006: 432,846,234.61; 2007: 455,908,505.67
Any comment:	

Data / Parameter:	11 OC
Data unit:	MW
Description:	Net power generation capacity of the open cycle gas turbine or engine (before the project activity)
Source of data used:	Historical data
Value applied:	213.36
Justification of the choice of data or description of measurement methods and procedures actually applied :	GTG 7 and GTG 8 is 106.68 MW respectively.
Any comment:	Capacity of the project power plant in combined cycle operation be given as declared net capacity.

Data / Parameter:	EF
Data unit:	tCO_2e/MWh
Description:	Emission factor of displaced electricity by the project activity.
Source of data to be used:	Study on Grid Connected Electricity Baselines in Malaysia
Value applied	0.956
Justification of the choice of data or description of measurement methods and procedures actually applied:	It is calculated based on "Tool to calculate the emission factor for an electricity system".
Any comment:	.

B.6.3. Ex-ante calculation of emission reductions:

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As stated in the Section B.6.1, the amount of emission reduction can be calculated from the formula shown below.

$ER_y = BE_y - PE_y - L_y$

Where:

ER_y The emissions reductions due to the project activity during the year *y* in tons of CO_2
BE_y The baseline emissions due to displacement of electricity during the year *y* in tons of CO_2
PE_y The project emissions during the year *y* in tons of CO_2
L_y The leakage emissions during the year *y* in tons of CO_2

Project Emission (PE_y)

As stated in the Section B.6.1, the project emissions (PE_y) can be calculated from the formula shown below.

$PE_y = PEGT_y$

$PEGT_y = \Sigma_i (FGT_{i,y} * NCV_i * EF_{CO2,i})$

where:

FGTi,y The amount of fuel i (in a mass or volume unit) consumed to operate the gas turbine by the project in year y.
NCV The net calorific value (energy content) per mass or volume unit of the fuel used.
$EFCO_2$ The CO_2 emission factor per unit of energy of the fuel used.

For each parameter above, estimated value indicated in Section B.6.2 and B.7.1 is assigned as follows:

PE_y $= PEGT_y + PEST_y$
$= \Sigma_i (FGT_{i,y} * NCV_i * EF_{CO2,i})$
$= (460,935,719.25 * 42.6 * 0.0000561) + (518,471.82 * 37.2 * 0.0000741)$
$= 1,101,572 + 1,429$
$=$ **1,103,001 (tCO2/yr)**

Baseline emissions (BE_y)

As stated in the Section B.6.1, the baseline emissions (BE_y) can be calculated from the formula shown below.

$BE_{X,y} = (EF_{OC} * OG_{X,y}) + (EF_{grid,y} * (PG_y - OG_{X,y}))$

where:

EF_{OC} Emission factor for plant operational in Open Cycle Mode in tCO_2/MWh.
$OG_{X,y}$ Electricity generated by the open cycle in the baseline (in MWh); as shown below, this is calculated in two ways based on historical data ($OG_{H,y}$), or based on the load factor in the project plant ($OG_{P,y}$) and Index X is either "H" or "P".

PG_y Actual electricity generated by project in year y (MWh)
EF_{grid} The CO_2 emission factor for the electricity displaced due to the project activity during the year y in tones tCO_2/MWh.

Step 1: Estimating $OG_{X,y}$
(i.) Amount of baseline power generation assuming on historical data (in MWh):

$OG_{H,y} = HG_{OC}$

Where:
HG_{OC} The average net annual generation from the operation of power plant in open cycle mode based on five years of generation records previous to start of the project (in MWh).

For each parameter above, estimated value indicated in Section B.6.2 and B.7.1 is assigned as follows:

$OG_{H,y} = HG_{OC}$
= **1,216,149.80(MWh)**

(ii.) Amount of baseline power generation calculated assuming load situation of project power plant (in MWh):

$OG_{P,y} = OC / PC * PG_y$

Where:
OC The net power generation capacity of the open cycle gas turbine (before the project activity) in MW
PG_y Actual electricity generated by project in year y (MWh)
PC Net installed power generation capacity (MW) of the project including both the open cycle (gas turbine) plus the steam turbine capacity

For each parameter above, estimated value indicated in Section B.6.2 and B.7.1 is assigned as follows:

$OG_{P,y} = OC / PC * PG_y$
= 213.36 / 323.73 * 2,088,424.30
= **1,376,413.09 (MWh)**

Step 2: Estimating EF_{OC}, the emissions factor for electricity generated in open cycle mode in the baseline
$EF_{OC} = FC_{HIST} / HG_{OC,x} * NCV * EFCO_2$

Where:
FC_{HIST} Annual average fuel consummation of the open cycle gas turbine (in mass of volume units) estimated using data for five years previous to start of the project
$HG_{OC,x}$ The average net annual generation from the operation of power plant in open cycle mode based on 'x' years of generation records previous to start of the project (in MWh)
NCV The net calorific value (energy content) per mass or volume unit of the fuel
$EFCO_2$ The CO_2 emission factor per unit of energy of the fuel

For each parameter above, estimated value indicated in Section B.6.2 and B.7.1 is assigned as follows:

$EF_{OC} = FC_{HIST} / HG_{OC,x} * NCV * EFCO_2$
= (403,077,159.60 * 42.6 * 0.0000561 + 452,881.68 * 37.2 * 0.0000741) / 1,216,149.80
= **0.793 (tCO2/MWh)**

Step 3: Determine the emissions factor for the operating margin
According to "Study on Grid Connected Electricity Baselines in Malaysia", combined margin emission factor is **0.956 (tCO2/MWh).**

Step 4: Conservatively determine baseline emissions
The baseline emission BE_y for year y is the lower value between the baseline emissions calculated on the basis of historical power generation, $BE_{H,y}$, and the baseline emissions calculated based on the load factor of the project situation, $BE_{P,y}$:

$BE_{H,y} = (EF_{OC} * OG_{H,y}) + (EF_{grid,y} * (PG_y - OG_{H,y})$
= 0.793 * 1,216,149.80 + 0.956 * (2,088,424.30- 1,216,149.80)
= **1,798,301 (tCO2/year)**

$BE_{P,y} = (EF_{OC} * OG_{P,y}) + (EF_{grid,y} * (PG_y - OG_{P,y})$
= 0.793 * 1,376,413.09 + 0.956 * (2,088,424.30 - 1,376,413.09)
= **1,772,178 (tCO2/year)**

$BE_y = MIN (BE_{H,y}, BE_{P,y})$
= **1,772,178 (tCO2/year)**

Leakage(L_y)
As stated in the Section B.6.1, leakage is zero.

Estimation of emission reductions
$ER_y = BE_y - PE_y - L_y$
= 1,772,178 − 1,103,001 −0
= **669,177 (tCO2/yr)**

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

>>

The following table shows the summary of ex-ante estimation of emission reductions for the crediting period.

Table. Estimated emission reductions

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2009	459,584	738,408	0	278,824
2010	1,103,001	1,772,178	0	669,177
2011	1,103,001	1,772,178	0	669,177
2012	1,103,001	1,772,178	0	669,177
2013	1,103,001	1,772,178	0	669,177
2014	1,103,001	1,772,178	0	669,177
2015	1,103,001	1,772,178	0	669,177
2016	643,417	1,033,771	0	390,354
Total	7,721,007	12,405,247	0	4,684,240

Note: Crediting period starts on 01/08/2009 and ends on 31/07/2016.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	1. $FGT_{i,y}$
Data unit:	NM3/year
Description:	Consumption of natural gas of project during the year for operating gas turbine.
Source of data to be used:	Measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	460,935,719.25 2009: 460,935,719.25 2010: 460,935,719.25 2011: 460,935,719.25 2012: 460,935,719.25 2013: 460,935,719.25 2014: 460,935,719.25 2015: 460,935,719.25 2016: 460,935,719.25
Description of measurement methods and procedures to be applied:	For **GT7&8**, currently, there are no operational flow meters. The gas volume is calculated using the following formula: FGT7&8 = FShell – FGT1-6 Where 1) FGT7&8 is the volume of fuel used by GT7&8, 2) FShell is the volume of gas as provided by Shell every month, and 3) FGT1-6 is the volume of fuel used by the remaining GTs 1,2,3,4,5 & 6. *In the future, should CDM requires it, SPG will install separate flow meters for GT7 and GT8.* For **ST 9**, there is no fuel consumption, so no measurements. ST 9 has no option for diesel or gas firing.
QA/QC procedures to be applied:	Direct measurements at the plant site should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes. Meters should be subject to regular maintenance and testing regime to ensure efficiency.
Any comment:	

Data / Parameter:	1. $FGT_{i,y}$
Data unit:	Litre/year
Description:	Consumption of diesel fuel oil of project during the year for operating gas turbine.
Source of data to be used:	Measurement
Value of data applied for the purpose of	460,935,719.25

calculating expected emission reductions in section B.5	2009: 518,471.82 2010: 518,471.82 2011: 518,471.82 2012: 518,471.82 2013: 518,471.82 2014: 518,471.82 2015: 518,471.82 2016: 518,471.82
Description of measurement methods and procedures to be applied:	There are individual flow meters for diesel to GT 7 & GT 8.
QA/QC procedures to be applied:	Direct measurements at the plant site should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes. Meters should be subject to regular maintenance and testing regime to ensure efficiency.
Any comment:	

Data / Parameter:	3&9. NCV (Natural Gas)
Data unit:	MJ/Nm3
Description:	Net calorific value of natural gas
Source of data used to be used:	Measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	42.6 (= 50.572 MJ/kg X 0.798 kg/sm3 X 288/273 = 42.6 MJ/NM3)
Description of measurement methods and procedures to be applied:	Average yearly calorific value is measured and calculated. (It is measured by Shell.)
QA/QC procedures to be applied:	The data is measured by Shell and calculated by Project Participants.
Any comment:	

Data / Parameter:	3&9 NCV (Diesel Fuel Oil)
Data unit:	MJ/litre
Description:	Net calorific value of diesel fuel oil
Source of data used to be used:	Contract
Value of data applied for the purpose of calculating expected emission reductions in section B.5	37.2 (= 44.6 MJ/kg X 0.835 kg/litre = 37.2 MJ/litre)
Description of measurement methods and procedures to be	Contract value is checked annually.

applied:	
QA/QC procedures to be applied:	The latest contract is checked.
Any comment:	

Data / Parameter:	4&9. $EFCO_2$ (Natural Gas)
Data unit:	t-CO_2/MJ
Description:	CO_2 emission factor for natural gas
Source of data used to be used:	2006 IPCC Guideline
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0000561
Description of measurement methods and procedures to be applied:	IPCC default value is checked annually.
QA/QC procedures to be applied:	The latest IPCC report is checked.
Any comment:	

Data / Parameter:	4&9. $EFCO_2$ (Diesel Fuel Oil)
Data unit:	t-CO_2/MJ
Description:	CO_2 emission factor for natural gas
Source of data used to be used:	2006 IPCC Guideline
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0000741
Description of measurement methods and procedures to be applied:	IPCC default value is checked annually.
QA/QC procedures to be applied:	The latest IPCC report is checked.
Any comment:	

Data / Parameter:	6. PGy
Data unit:	MWh
Description:	Net quantity of electricity generated by the project power plant
Source of data to be used:	Measurement
Value of data applied	2,088,424.30

for the purpose of calculating expected emission reductions in section B.5	<table><tr><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td>2013</td></tr><tr><td>2,088,424.30</td><td>2,088,424.30</td><td>2,088,424.30</td><td>2,088,424.30</td><td>2,088,424.30</td></tr></table><table><tr><td>2014</td><td>2015</td><td>2016</td></tr><tr><td>2,088,424.30</td><td>2,088,424.30</td><td>2,088,424.30</td></tr></table>
Description of measurement methods and procedures to be applied:	The readings for net quantity of electricity generated by GT7 and GT8 are taken by the Plant Operators. Official readings are taken at 12 midnight daily. The unit of net generation capacity is measured in MWh. For ST9, the above procedures will also be followed.
QA/QC procedures to be applied:	The consistency of metered net electricity generation should be cross-checked with receipts from sales.
Any comment:	Electricity used for the operation of the plant should be subtracted.

Data / Parameter:	7. PC
Data unit:	MW
Description:	Net generation capacity of the project power plant.
Source of data to be used:	Measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	323.73 MW Nameplate capacity of GTs and ST is below: - GTG 7: 106.68 MW - GTG 8: 106.68 MW - STG 9: 110.37 MW
Description of measurement methods and procedures to be applied:	The readings for net generation capacity of GT7 and GT8 are taken by the Plant Operators. Official readings are taken at hourly on daily basis. The unit of net generation capacity is measured in MW. For ST9, the above procedures will also be followed.
QA/QC procedures to be applied:	The capacity is checked by the Plant Operators daily.
Any comment:	

B.7.2. Description of the monitoring plan:

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All monitoring equipment will be installed by experts and regularly calibrated to the international standards or manufacturer's manual by Sarawak Power Generation. The staff at the project site will be trained in the operation of all monitoring equipment. All reading will be taken under the supervision of management. Sarawak Power Generation will appoint an executive to be responsible for all data monitoring / acquisition and recording for CDM purposes.

Monitoring Plan

1. Responsibility of the Project Management

Sarawak Power Generation will be responsible for the execution of the monitoring plan. It will collect and store relevant data in a systematic and reliable way, evaluate them regularly and ensure the availability of pertinent information for verification. An electronic spreadsheet file will be kept to record and manage all monitored variables and will be regularly presented to the DOE for verification.

2. Quality Assurance and Quality Control

The quality assurance and quality control for recording, maintaining and archiving data shall be maintained by Sarawak Power Generation. It will also make sure that it provides the staff in charge of data collection and monitoring with necessary training opportunities to enhance efficiency of their work.

3. On-site Procedures

Operation and Maintenance Logs

Daily O&M logs will be maintained by each shift leader on a real time basis. They will provide detailed on the-spot information about the operation of the plant. Any event of significance will be reported and recorded in a special log.

Operation and Maintenance Report
This report will be developed each month and represented to Sarawak Power Generation management. The report will include the following topics:

- Summary
- Accidents, malfunctions and remedial measure taken
- Safety and environment
- Plant performance and availability
- Meter records
- Auxiliary Fuel consumption report
- Personnel changes

Procedure for Calibration of Equipment

Sarawak Power Generation will carry out calibration according to the international standards or manufacturer's manual.
It is important to note that Sarawak Power Generation will be required to install and maintain all metering equipment confronting to specifications.

Procedure for handling of erroneous measurement, monitoring data adjustment and data uncertainty

Operating staff is responsible for reporting erroneous measurement, uncertainty of parameters for which he/she is responsible. The report is sent to the executive for review and further action. Any erroneous measurement and uncertainty found is recorded and the executive is required to initiate corrective actions.

Procedure for training of monitoring staff

Regular training (Monthly and/or quarterly) is provided to the operating staff by the executive after he/she reviews the report from the operating staff. When new equipments are installed and/or the maintenance for the monitoring equipments is carried out, training for the proper management and operation of the equipment will be provided to the operating staff.

Procedure for handling of emergencies situations

In accordance with the internal regulation, an Emergency Management Plan will be prepared. Personal safety appliances are provided to the operating staff according to the requirement. Regular training for safety is provided to the operating staff by the executive during the regular training mentioned above

Procedure for review of reported results/data and corrective action

The executive is responsible for reviewing the parameters recorded by the operation staffs. If any error is founded during the monitoring, the corrective action will be ensured by the executive.

4. Data Storage and Filing – Electric Workbook

All relevant data will be monitored and electronically stored at least 2 years after the end of the crediting periods.

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):

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Date of completion of the application of the baseline study and monitoring methodology

The baseline study and monitoring plan above were completed in April 11, 2008.

Name of person(s)/entity(ies) responsible for the application of the baseline and monitoring methodology to the project activity

Mr. Kenjiro Suzuki
Global Environment Department
Pacific Consultants Co., Ltd.
2-7-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163-0370 Japan
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2-7-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163-0370 Japan
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Pacific Consultants Co., Ltd. is a consulting firm with CDM-related expertise. The firm 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:

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The starting date is the date of Board Resolution i.e. 07/09/07.

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

>>
17 years
(The current purchase agreement on natural gas is expired in 2023, and after 2023 it is uncertain whether the current agreement can be extended or not.)

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

C.2.1. Renewable crediting period:

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

>>
01/08/2009

The start date of the crediting period will not commence prior to the date of registration.

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

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

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Section 34A of the Environmental Quality (Amendment) Act 1996, under Schedule 13(c) Construction of combined cycle power stations of the Environmental Quality (Environmental Impact Assessment) Order 1987, requires a Preliminary Environmental Impact Assessment (PEIA) to be carried out and submitted to the Department of Environment (DOE). This is to fulfil the requirement of the environmental legislations in Malaysia.

This PEIA study was carried out at various stages of the development, including site investigation stage, site preparation and construction stage, operational and maintenance stage, and abandonment stage. Potential impacts arise from each stage of the Project together with the mitigation measures are identified and adequately addressed to ensure that all the activities associated with the development of the Project will be carried out in a sound and safe manner. A summary of the impacts and mitigation measures is as presented in the following table.

(1) Project siting

Main Process	Potential Significant Environmental Impacts	Proposed Mitigation Measures
Site Location - Site observation - Site survey	• Insignificant physico-chemical and biological environment	Not necessary.

(2) Site preparation and construction

Main Process	Potential Significant Environmental Impacts	Proposed Mitigation Measures
Site Clearing and Piling Works - Site clearing - Foundation works - Piling works	• Minor soil erosion • Minor air pollution and noise pollution	**Erosion/Sediment Control** Proper planning and timing of work must be established. Clearing and foundation works as well as other disturbance activities should be created temporarily during period of high rainfall. Temporary drainage will be constructed to drain the site's water and will be integrated into silt trap prior channel to existing perimeter drainage later. Periodically monitoring and maintenance of the silt trap to be carried out. Universal Soil Loss Equation will be used to estimate the amount of soil loss in tonnes per hectare per year at the surrounding of the Project area. **Safety & Protection** Construction site fence will be built between the construction site and the existing plant to minimize dust dispersion and also to prevent any unauthorized person from entering the existing plant.

		Personal Protective Equipment (PPE) is compulsory for workers on site. **Solid Waste Management** Any burning of waste at site is strictly prohibited. Vegetative debris to be removed and stacked in designated area adjacent to the Project site for natural degradation. The remaining leftover will be sent to BDA approved dumping site.
Establishment of Site Office and Workers Rest Area - Site office, workers rest area, toilet set up	• Communicable disease	**Workers Employment Procedure & Compliance** Local workforces should be prioritized. If foreigners are to be employed, proper documentation in compliance with the Immigration and Labour Rules and Regulation and monitoring of these workers must be strictly enforced. **Labour Screening** All workers should be screened for illness as a condition for employment. Follow-up medical checks should be carried out periodically (every six months).
	• Sanitary facilities	**Proper Hygienic Sanitary Allocation** Provision of proper workers sanitary facility according to local authority requirement. Discharge through drainage system is to be in compliance with Standard B of the Environmental Quality (Sewage and Industrial Effluents) Regulation, 1979.
	• Solid waste disposal	**Solid Waste Management** Garbage bin to be provided adequately where required. All solid wastes to be collected and stored according to local standard. The contractor should collaborate with DOE approved prescribed premises for the collection and disposal of these wastes.
Transportation of Construction Materials and Machinery - Transporting of construction materials (i.e. ready mixed concrete, steel plates etc) - Transporting of machineries (compressor, compactor, crane etc)	• Increase in vehicular movement, noise, dust level and exhaust emission (Dust & Noise will be localized and short-term)	**Dust Suppression and Control** Dust levels and condition to be visually monitored. Lorry carrying soil and loose construction materials should be covered with canvas or tarpaulin sheets and fasten securely. Temporary wash trough to be provided. Road to be sprinkled with water in construction site. **Traffic Management** Proper road signs and warning should be provided at the Project access road and internal roads. Speed limit should be imposed. All vehicles should abide to traffic rules. **Noise Control** Construction activities shall be limited to day-light hours and in accordance with sound level permitted under DOE-The Planning Guidelines for Environmental Noise Limit and Control, 2004. Construction equipment equipped noise silencer or noise reduction devices should be recommended. **Monitoring and Maintenance** Construction vehicles are to be regularly maintained and cleansed.

Construction of Buildings and Installation of Plants and Equipment - Steam turbine generating plant - Heat Recovery Steam Generator - Cooling Water Pump House - Water Treatment Plant - Wastewater Treatment Plant	• Increase in air pollution (dust and exhaust emissions) and noise pollution	**Monitoring and Maintenance** All construction vehicles and equipment are to be maintained regularly. Unpaved road in construction site are to be sprinkled with water. Noisy construction works should be confined to daytime only. Noise monitoring to be carried out periodically at Project's boundary.
	• Safety and health of construction workers	**Safety and Health** Safety measures with regards to loading and transportation of materials should be strictly observed. On-going supervision is needed and complied with Factory & Machinery (Building Operations and Works of Engineering Construction) Safety Regulations, 1986. Safety protective gears to be provided for workers.
	• Disposal of construction wastes and debris	**Solid Waste Management** Proper disposal at approved dumpsite by licensed contractor. Open burning is strictly prohibited.
	• Spillage may occur (spend lubricant oil/used oil) from generated by generators, compressors or other construction machineries	**Hazardous Waste Management** Spent lubricant oil/used oil shall be handled in accordance to the requirements stipulated in the Environmental Quality (Schedule Wastes) Regulations 2005.
	• Open space, land (uncovered by vegetation)	**Landscaping and Revegetation** Open spaces should be revegetation to minimize exposed land area and to beautify the site area.
	• Disturbance to the marine habitat and marine life due to installation of the cooling water intake and discharge outfall pipelines	**Sediment Release** Marine disposal of excavated material should be done away from sensitive fisheries or breeding grounds. Disposal activities should be timed to be outside of upwelling period. **Disturbance of Aquatic Resources** Construction wastes will not be disposed off in the sea. **Interference to Coastal Fishing** Construction period should be performed during periods of low fishing activity and to be scheduled to minimize impact on fishing activities. **Interference to Navigation at the Sea** Barges, buoys and watercrafts should be put around the construction area and to be clearly marked and illuminated at night. Proper authorization should be obtained prior to commencement of offshore work.

(3) Operation and Maintenance

Main Process	Potential Significant Environmental Impacts	Proposed Mitigation Measures

Procurement of Utilities - Availability of utilities and services	• No adverse impacts are expected.	Necessary application to the relevant authorities.
Air Quality - Gas emission from gas turbines of existing GTG-7 and GTG-8	• Air emission from the gas turbines can adversely affect human health and the environment	The plant will comply with good engineering practice stack height to facilitate dispersion of emitted gases. Maintenance of the plant should be carried out periodically to ensure the effectiveness of air pollution control.
Marine Environment - Marine habitat - Water quality	• Seawater intake facility will entrain and impinging marine life • Thermal discharge from the water cooling system will increase the water temperature within the vicinity of the discharge location • Spent lubricant oil and hydraulic oil spillage during plant maintenance into the seawater • Chlorinated water discharge from water cooling system	**Marine Life** Suitable location of seawater intake head to be made to minimize impact on aquatic environment. The intake head will be installed with double-way entrance gates with bar screen to prevent floating matters and marine life from entering into it. **Thermal Discharge** Thermal plume modelling will be constructed to monitor the thermal impact from the discharge to the marine environment. Thermo meter will be installed to monitor the temperature of discharged cooling water. **Used Oil Spillage** The impacts of spillage can be minimized through proper storage and handling by experienced personnel. The used oil should be labelled and stored in clammed drum at a designated area in the plant. The storage area should be bunded with reservoir capacity of 110% to support any spillage. **Chlorinated Water Discharge** The dosing system from the cooling water pump house will be required to deliver minimum chlorine in the returned cooling water and will implement 'pulse' chlorination to minimize chlorine dosage levels.
Noise - Noise emission from turbines exhaust gas, generators, valves and pumps.	• Increase in noise pollution	**Noise** Control equipment such as silencer will be installed at the existing exhaust gas turbine to reduce noise generation. The combustion turbines will be enclosed to minimize the noise levels. Workers in the vicinity of the plant must use hearing protective equipment such as ear mufflers. A nose assessment was implemented to forecast any noise generation impact from the Project towards the existing Bintulu Power Station and surrounding industries.
Aesthetics	• Alteration of the landscape may cause displeasing appearance of the area	The surrounding area of the power plant will be planted with trees and grass to create greenery scenery. Only affected trees will be removed from the Project site and others are to be untouched. Landscaping programme will be implemented for the beautification of the power plant.

Socio-economic Aspect	• The operation of the power plant will provide alternative sources of employment to the local population • Emission of gas and noise will affect the public's safety and health • Worker's negligence to the safety regulations at the site during operation time	The Project Proponent should be responsible towards the monitoring of the foreign workers' activities and social problems that may arise. Mitigation measures for air quality and noise are to be implemented to enhance the public's safety and health. Proper safety planning and procedures should be implemented to minimize any work injuries on the plant's workers.
Wastewater Treatment Plant (WWTP)	• Wastewater discharge	The residue process water generated from the plant will be channelled to the wastewater treatment plant and it will be treated prior final discharge through normal plant drainage system. The designated WWTP is expected to have the capability to treat generated residual up to Standard B of the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 before being discharged into the sea.
Scheduled Waste Management - Used oil generation during plant maintenance and also from oil separator(s).	• Impacts to the aquatic life and coastal environment	All oily drains and contents from containment basin will be collected into the oily water collection system and routed through an oil separator(s). Proper labelling and storing in clammed drum. The drums are kept temporarily in a designated area before being disposed at DOE licensed contractor for recovery and disposal. The storage area shall be bunded with reservoir capacity of 110% to support any spillage. Frequent inspection and maintenance should be carried out to monitor the situation.
Stormwater Management	• Contaminated water	Stormwater run-off from administration building, car park area, non-bunded areas and pathways are to be directed to the offsite stormwater drains. Site inspection is to be conducted periodically to ensure that there is no spillage of used oil into the drainage.
Sewage Disposal	• Sewage disposal may deteriorate water quality	The sewage system must meet the local authority and DOE requirements. Regular maintenance and monitoring of the septic tank to be conducted.
Land Use	• No adverse impacts are expected	Not necessary

(4) Project Abandonment

Main Process	Potential Significant Environmental Impacts	Proposed Mitigation Measures
Abandonment During Pre-Construction / Site Investigation	• Little and insignificant impacts on the environment	Not necessary.

Stage		
Abandonment During Construction Stage	• Aesthetic	Remove the structures and other installations. Removal of equipment and plant should be well planned. Necessary restoration of the site should be undertaken.
Abandonment During Operation and Maintenance Stage	• Greater monetary losses • Aesthetics due to the visual impact of abandoned building and tanks	Remove the structures and other installations. Well-planed removal of equipment and plant. Necessary restoration of the site should be undertaken.

The assessment of potential environmental impacts from implementation of the Project during construction and operational stages had shown that they are within the acceptable levels as long as appropriate mitigating measures provided are taken into account. The impacts are considered within the acceptable levels as the Project sited within industrial designated area and far from human settlement area.

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:

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As described above, with proper incorporation of the recommended environmental protection measures undertaken by Project Proponent, the project should be continued with minimum acceptable environmental impacts.

SECTION E. Stakeholders' comments

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

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A local stakeholder's meeting has been conducted by Sarawak Power Generation on 13th March 2008 at ParkCity Everly Hotel, Bintulu, Sarawak to collect stakeholder's comments on Bintulu Combined-Cycle CDM project. Key stakeholders were invited, including Department of Environment(DOE), Sarawak Electricity Supply Corporation(SESCO).

The meeting started with an explanation of the purpose of the stakeholders meeting, followed by an introduction to the Panel of Speakers, by Mr. Leslie Chai Kim Pau, SEB's Manager for Renewable Energy.

1) Mr. Yong Khiong Choon, the SEB General Manager (Business Development) and SPG Director, explained the organizational structure and function of Sarawak Energy Berhad and Sarawak Power Generation. The explanation covered the major departments and subsidiaries of the organization. He introduced the rationale for the project, its benefit to the environment and the need for the application of Clean Development Mechanism for the Bintulu Combine-Cycle Conversion Project.

   Mr. Kueh Lak Tee, the Project Manager explained the technical aspect of the project. Currently existing at the site are 2 units of GE 110MW Frame 9 Gas Turbines operating in Open Cycle or Simple Cycle mode. With this mode of operation, the exhaust gas temperature equivalent to 550 °C, is not used. This exhaust heat can be utilized to generate more electricity.

   Under this project, Sarawak Power Generation will install two new units of Heat Recovery Boiler/Steam Generator (HRSG) and one unit of Steam Turbine Generator (STG) together with all necessary systems and auxiliaries. This will enable the hot exhaust gas from the Gas Turbine to be recovered and injected into the HRSG so that steam is generated to turn the Steam Turbine Generator. Sarawak Power Generation will gain an extra 110MW of power

through this, without having to increase fuel consumption, thus eliminating further emission of CO2.

This plant is expected to be in commercial operation by October 2009.

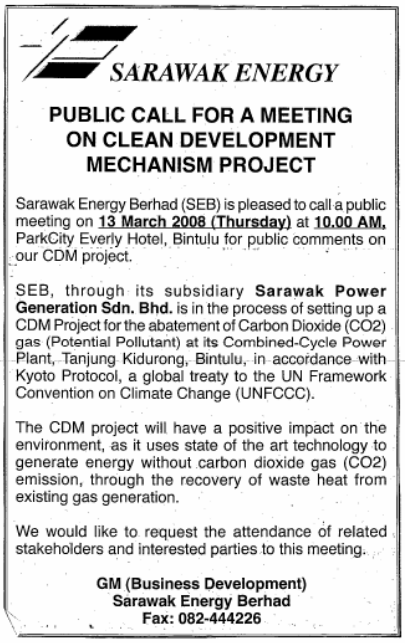
2) Miss. Karen Lee the Environment Executive of Sarawak Energy informed that the Department of Environmental (DOE) has approved the EIA for this project on 14th January 2008. She then proceeded to explain on the existing environment on site, the impact of the project on the environment and all the precautions and measures SEB/SPG are taking and have taken to ensure minimal impact and compliance.

3) Mr. Masataka Shimazu (Assistant General Manager) of Mitsubishi Corporation concluded the session with a presentation on global warming, its impact on the future environment and the need for immediate attention on a global scale to prevent the worst-case scenario. He also explained the objective of the Clean Development Mechanism and its application process and procedures.

The participants expressed their interests and supports on the CDM project, and raised some questions about CDM and the project too. Furthermore, in local stakeholders meeting, the opinions of attendants were collected in the form of questionnaire.

Sarawak Power Generation released an announcement on Bintulu Combined-Cycle CDM project at the following newspaper on February 28th, 2008.

1) The Borneo Post - English
2) Utusan Sarawak - Bahasa Malaysia



SARAWAK ENERGY

PUBLIC CALL FOR A MEETING ON CLEAN DEVELOPMENT MECHANISM PROJECT

Sarawak Energy Berhad (SEB) is pleased to call a public meeting on **13 March 2008 (Thursday)** at **10.00 AM,** ParkCity Everly Hotel, Bintulu for public comments on our CDM project.

SEB, through its subsidiary **Sarawak Power Generation Sdn. Bhd.** is in the process of setting up a CDM Project for the abatement of Carbon Dioxide (CO2) gas (Potential Pollutant) at its Combined-Cycle Power Plant, Tanjung Kidurong, Bintulu, in accordance with Kyoto Protocol, a global treaty to the UN Framework Convention on Climate Change (UNFCCC).

The CDM project will have a positive impact on the environment, as it uses state of the art technology to generate energy without carbon dioxide gas (CO2) emission, through the recovery of waste heat from existing gas generation.

We would like to request the attendance of related stakeholders and interested parties to this meeting.

GM (Business Development)
Sarawak Energy Berhad
Fax: 082-444226

E.2. Summary of the comments received:

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The following questions were raised during the stakeholders meeting:

1) Dr. Kamaludin — JMG
Question: Please explain whether Sarawak needs this much power, especially with the 2,400MW Bakun HEP under construction.

2) Mr.Khairul Ariffin Idris — Malaysia Liquified Natural Gas. (MLNG)
Question: What is the temperature of the discharge water and are there any treatment for the wastewater?

3) Mr.Wee Bong Hong — Department of Chemistry
Question: How long can the supply of natural gas to the power station be continued?

4) Alan Liew — SEB/SES
Question: Will Sarawak Energy convert all remaining open cycle units to combine cycle?

19 Additional comments were also collected through a question and answer sheet distributed to the stakeholders in attendance.

Q1. Do you think that the project will contribute to the sustainable development of the area? Please give reason to your answer.

Comment	Numbers	Summary
Yes	16	• Provide more job opportunities to the local community. • Reduce the consumption of raw material (natural gas) and the emission of CO_2. • Produce more energy to support the sustainable development of the area.
No	0	
N.A	3	

Q2. Do you think that the project will result in positive environmental impacts in the surrounding area? Please give reason to your answer.

Comment	Numbers	Summary
Yes	11	• Utilize the usage of the waste heat. • Reduce greenhouse gas emissions.
No	4	• BOD & COD will increase due to higher temperatures. • Depends on how the project is managed to the main concern like the temperature and content of discharge to the sea.
N.A	4	

Q3. Do you oppose the implementation of the project? Please give reason to your answer.

Comment	Numbers	Summary
Yes	0	
No	18	• This project carries along with it, business and employment opportunities. • This project will ensure the continuity of the power supply. • To reduce global warming for the benefit of the next generation.
N.A	1	

Q4. Do you think that Sarawak Energy, Sarawak Power Generation, the local Government, the wider project area and Malaysia will benefit from such a project? Please give reason to our answer.

Comment	Numbers	Summary
Yes	16	• Generate more energy to support the sustainable development of the area. • Reduce the usage of resources (natural gas) • Increase the living standard of the local population
No	1	
N.A	2	

Q5. Do you have any other comments you want to add?

Comment	Numbers	Summary
Yes	2	• Ensure that there is no extra pollution to the seawater. • Carry out annual monitoring system to ensure the reduction of CO_2 emission.
No	3	
N.A	14	

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

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The questions raised by the participants were answered as follows;

1) Dr. Kamaludin	JMG
Question:	Please explain whether Sarawak needs this much power, especially with the 2,400MW Bakun HEP under construction.
Answer by Mr.Yong:	The 2,400MW Bakun HEP is expecting its first 300MW unit to be completed by 2010. However, the firm power from Bakun is only about 1600MW and this has already been earmarked for transmission to Peninsular Malaysia and for other large industries such as the aluminum smelter. In fact, Sarawak is currently facing a shortage of power. With an installed capacity of about 865MW and a peak demand of about 800MW this year, our reserve margin is very low. If any of our big capacity power units were to fail (forced outage), Sarawak will likely face a power shortage.
2) Mr.Khairul Ariffin Idris	Malaysia Liquified Natural Gas. (MLNG)
Question:	What is the temperature of the discharge water and are there any treatment for the wastewater?
Answer by Miss Karen:	The temperature of the water discharge is ±2 °C of the intake water temperature. There is a wastewater treatment plant to treat the wastewater to accommodate the ruling set by Department of Environment (DOE).
3) Mr.Wee Bong Hong	Department of Chemistry
Question:	How long can the supply of natural gas to the power station be continued?
Answer by Mr.Yong:	Currently, about 60% of the power generated in Sarawak is through natural gas. Our future gas supply depends very much on the availability of gas and the price of gas. Moreover, natural gas is an exhaustible resource and therefore, alternative power sources such as hydropower and coal are also required to be developed.
4) Alan Tan	SEB/SES
Question:	Will Sarawak Energy convert all remaining open cycle units to combine cycle?
Answer by Mr.Yong:	Some of the existing gas turbine units are quite old and may not sufficient life left to be converted into a combined cycle plant. Furthermore, the investment cost of the combined cycle units are very expensive and

	without the support of CDM revenue, the project is unlikely to materialize.

The concern for the wastewater was raised through the questionnaire.
The following action will be taken for that concern.

- The temperature of the water discharge will be kept at ±2 °C of the intake water temperature. There will a wastewater treatment plant to treat the wastewater to accommodate the ruling set by Department of Environment (DOE) and ensures the operation to be in accordance with the EIA already approved by the Department of Environment.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the proposed project activity.

Annex 3

BASELINE INFORMATION

Please refer to Section B.4, 5 and 6.

Annex 4

MONITORING INFORMATION

Please refer to Section B.7.

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