



NO. 1, PERSIARAN DATO' MENTERI, SECTION 2,
40700 SHAH ALAM, SELANGOR DARUL EHSAN
MALAYSIA
Tel.: 603-55446479
Fax: 603-55446787
www.sirim-sqas.com.my

Validation Report

Project Title:

Natural Gas based cogeneration
plant at IRPC Public Co. Ltd.
Thailand

Report No.:SQAS-CDM-ES12880049

Date : 27th November 2012



Date of first issue: 9 May 2011	Project No.: SQAS-CDM-ES12880049
Approved by: Parama Iswara Subramaniam	Project title: Natural gas based cogeneration plant at IRPC Public Co. Ltd. Thailand
Client: IRPC Public Company Limited, Bangkok	Organization unit: SIRIM QAS International Sdn Bhd

Summary:

SIRIM QAS International Sdn. Bhd. has performed a validation of the "Natural gas based cogeneration plant at IRPC Public Co. Ltd. Thailand" in Thailand, based on the Kyoto Protocol requirements, UNFCCC rules and associated interpretations. The validation exercise was not meant to provide any consulting to the project participants. However, the stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

The validation consisted of three phases; i) a document review of the project design documents and preparation of validation protocol, ii) on-site visit to the project activity and interviews with the project developer and the project consultant, and iii) resolution of outstanding issues and the issuance of final validation report and validation opinion.

The proposed CDM project activity is construction and operation of a new natural gas based cogeneration plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid. Under the project activity, a new natural gas based cogeneration plant is being installed in phase wise commissioning plan. The total installed capacity of the project activity plant will be (6 x 37.972) 227.83 MW and (6 x 68.083) 408.49 TPH at IRPC Industrial Estate in Rayong. The main purpose of the project activity is to generate electricity through less GHG intensive fuel, such as natural gas (NG), that displaces electricity from an electricity distribution system (Regional Grid) dominated by fossil fuel fired generating units. Out of the six gas engines, one unit of 37.972 MW will be always on standby, thus the available capacity for use is = $37.972 \times 5 = 189.86$ MW. Similarly, with one HRSG in standby, the available steam production capacity will be 340.42 TPH. The project is expected to generate and displace 189.86 MWh of electricity annually from the power deficit, fossil fuel dominated regional grid of Thailand, thereby contributing to GHG emission reduction of 2,613,930 tCO₂ over a period of 10 years and contributing to climate change mitigation efforts.

The validation process, from contract review to the issuance of validation report and validation opinion was conducted in accordance with SIRIM QAS Intl.'s internal procedures. The first output of the validation process was a list of corrective action requests and clarification requests (CAR and CL) which is presented in Table 3 of Appendix A of this report. As a result of these findings, the PDD was revised by the client.

In summary, it is the opinion of SIRIM QAS Intl.'s that the proposed CDM project activity has correctly applied the baseline and monitoring methodology for the project activity and meets the relevant UNFCCC requirements for the CDM and the relevant host country criteria.

Report No.: SQAS-CDM-ES12880049		
Report title: Natural Gas based cogeneration plant at IRPC Public Co. Ltd. Thailand		
Work carried out by:		
Ms. Aernida Abdul Kadir	: Validation team leader	
Dr. D. Siddaramu	: Validation team member	
Mr. Sai Prasad	: Technical Expert	
Technical Reviewer	: Mr. K. Sudheendra	
Work verified by	: Mr. Parama Iswara Subramaniam	
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Indexing terms

Climate Change, Kyoto Protocol
Large Scale Project Validation
Clean Development Mechanism



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Abbreviations

AM	Approved Baseline Methodology
BCM	Billion Cubic Meters
CAR	Corrective Action Request
CCPP	Combined Cycle Power Plant
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CL	Clarification Request
CO ₂	Carbon Dioxide
CO ₂ /MU	Carbon dioxide / Million Units
CO _{2e}	Carbon Dioxide Equivalent
DEDE	Department of alternative energy development and efficiency
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EF	Emission Factor
EIA	Environmental Impact Assessment
EPC	Erection Procurement & Commissioning
FO	Fuel Oil
GHG	Greenhouse gas(ses)
GSCP	Global Stakeholders Consultation Process
GSHR	Gross Station Heat Rate
HCA	Host Country Approval
HPS	High Pressure Steam
IRPC	IRPC Public Company Limited
LoA	Letter of Approval
LPS	Low Pressure Steam
MMCD	Million Meter Cube per Day
MoC	Modalities of Communication
MoV	Means of Verification
MP	Monitoring Plan
NG	Natural Gas
O & M	Operation and Management
ODA	Official Development Assistance
PDD	Project Design Document
PLF	Plant Load Factor
PP	Project Participant
PTT's	Petroleum authority of Thailand
QA/QC	Quality Assurance/Quality Control
SCM/day	Standard Cubic Meter / day
SGDB	Steam Generation Database
SIRIM QAS Intl.	SIRIM QAS International Sdn Bhd
tCH ₄ /PJ	Tonnes of Methane/ Peta Joules
UNFCCC	United Nations Framework Convention on Climate Change

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1.0 INTRODUCTION

IRPC Public Company Limited (hereafter referred to as project participant) had engaged SIRIM QAS International Sdn Bhd to perform validation of the "Natural gas based cogeneration plant at IRPC Public Co. Ltd. Thailand" (hereafter called as project activity) in Thailand. This report summarises the findings of the validation of the project, performed on the basis of UNFCCC criteria for CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to the Kyoto Protocol criteria, the CDM rules and modalities as agreed in the Bonn Agreement, the Marrakech Accords and the CDM Executive Board's decisions.

1.1 Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, the monitoring plan (MP), and the project's compliance with relevant UNFCCC and host country criteria are validated in order to confirm that the project design as documented is sound and reasonable and meets the stated requirements and identified criteria. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

1.2 Scope

The scope of the validation is defined as an independent and objective review of the project design document, the project's baseline study and monitoring plan and other relevant documents. The information in these documents is reviewed against Kyoto Protocol requirements, UNFCCC rules and associated interpretations.

SIRIM QAS Intl has based on the recommendations in the Validation and Verification Manual version 01.2^{1/} employed a risk-based approach in the validation, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consulting towards the client. However, the stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 GHG Project Description

IRPC Public Company Limited (IRPC) has undertaken construction of a combined heat and power (cogeneration) project in IRPC Industrial Estate in Rayong, Thailand. IRPC's industrial complex consists of an upstream, an oil refinery unit and a downstream petrochemical production.

The purpose of the project activity is construction and operation of a new natural gas based cogeneration plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid. Under the project activity, a new natural gas based cogeneration plant is being installed in phase wise commissioning plan. The total installed capacity of the project activity plant will be (6 x 37.972) 227.83 MW and (6 x 68.083) 408.49 TPH. Out of the six gas engines, one unit of 37.972 MW will be on standby, thus the available capacity for use is = $37.972 \times 5 = 189.86$ MW. Similarly, with one HRSG in standby, the available steam production capacity will be 340.42 TPH. The project is expected to generate and displace 189.86 MWh of electricity annually from the power deficit, fossil fuel dominated regional grid of Thailand, thereby contributing to GHG emission reduction of 2,613,930 tCO₂ over a period of 10 years and contributing to climate change mitigation efforts. The regional grid has a varied fuel mix with many old and significant new power plants including fuel oil, diesel, natural gas, lignite, coal etc.

1.4 Validation Team

1.4.1 Validation team member :

The following validation team was assigned to carry out the validation of the project.

Validation Team Leader : Ms. Aernida Abdul Kadir

Validation Team Member : Dr. D. Siddaramu

Technical Expert : Mr. Sai Prasad

Financial Expert : Mr. G.N. Jayaram

Ms. Aernida Abdul Kadir, the validation team leader holds a degree in Electrical and Electronics Engineering and a diploma in Palm Oil Milling and Technology Management. She has several years of working experience in the cogeneration system. She has been trained in the CDM validation and verification processes and is a qualified CDM lead auditor. She is also a qualified ISO 14001 lead auditor.

Dr.D.Siddaramu holds a Ph.D in Environmental Science and P.G. Diploma in Industrial Safety. He has more than 7 years of experience in research & development, and EIA projects viz., hydro power projects, stone quarrying & mining and biomass assessment studies. He has experience in monitoring air and noise quality, conducting socio-economic surveys and data analysis. He has been trained in the CDM validation and verification processes, and has been qualified in accordance with SIRIM QAS intl.'s qualification criteria as CDM lead auditor.

Mr. Sai Prasad holds a Degree in Bachelor of Engineering in Mechanical. He has more than 36 experience in the field of Engineering, Project Management, Construction, Operation & Maintenance and Industrial Health, Safety & Environment for oil & gas installations. He has been trained in the CDM validation and verification processes, and is a qualified Technical Expert as per SIRIM QAS Intl.'s qualification criteria.

Mr. G.N.Jayaram is a qualified Chartered Accountant (FCA) and possesses Diploma in Information System Audit (DISA), and is a member of the Institute of Chartered Accountants of India. He possesses more than 23 years of experience in the field of accountancy. i.e., in conducting statutory and internal audits of various public sector undertakings, and public and private limited companies. He has about 4 years of experience in financial appraisal and assurance related to CDM projects. He is well versed with the CDM rules and guidelines.

1.4.2 Technical reviewer

Mr. K. Sudheendra holds a Degree in Bachelor of Engineering in Electrical Engineering. He has more than 30 years of experience in Energy Sector. He has been trained in the CDM validation and verification processes, and is a qualified Technical Reviewer as per SIRIM QAS Intl.'s qualification criteria.

2.0 METHODOLOGY

The SIRIM QAS Intl.'s validation process consists of the following phases:

- i) a document review of the project design documents and preparation of validation protocol;
- ii) on-site visit to the project activity and interviews with project developer and project consultant;
and
- iii) resolution of outstanding issues and the issuance of final validation report and opinion

In order to ensure transparency, a validation protocol was customized for the project according to

the Validation and Verification Manual. The protocol describes criteria (requirements), means of verification and the results from the validating the identified criteria, in a transparent manner. The validation protocol serves the following purposes :

- it organizes, details and clarifies the requirements that a CDM project is expected to meet;
- it ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described below in Figure 1.

Validation Protocol Table 1: Mandatory Requirements			
Requirement	Reference	Conclusion	Cross Reference / Comment
Mandatory requirements that the project must meet.	Gives reference to the legislation or agreement where the requirement is found	This is acceptable based on evidence provided (OK), a CAR where there is risk of non-compliance with stated requirements or a request for CL where further clarifications are needed.	Used to refer to the relevant checklists in Table 2 to show how the specific requirement is validated. This is to ensure a transparent validation process.

Validation Protocol Table 2: Requirements Checklist			
Checklist question	Means of verification (MoV)	Comment	Draft and/or final conclusion
The various requirements in Table 2 are linked to checklist questions the project should meet. The checklist is organized in seven sections. Each section is further subdivided. The lowest level constitutes a checklist question.	Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.	The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.	This is either acceptable based on evidence provided (OK), or a CAR due to non-compliance with the checklist question or CL when the validation team has identified a need for further clarification.

Validation Protocol Table 3: Resolution of Corrective Action and Clarification Requests			
Draft report clarifications and corrective action requests	Ref. to checklist question in table 2.	Summary of project owner response	Validation conclusion
If the conclusions from the draft Validation are either a CAR or CL, these should be listed in this section.	Reference to the checklist question number in table 2 where CAR or CL is explained.	The responses given by the project participants during the communications with the validation team should be summarized in this section.	This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in table 2, under 'Final Conclusion'

Figure 1: Validation protocol tables

The completed validation protocol of the "Natural Gas based cogeneration plant at IRPC Public Co. Ltd. Thailand" is in Appendix A of this report.

Findings established during the validation were classified as non-fulfillment of validation protocol criteria or where risks to the fulfillment of project objectives were identified. Corrective Action Request (CAR) was issued, where:

- i) mistakes have been made that directly impact on the project results; or
- ii) validation protocol requirements have not been met; or
- iii) there was a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

The validation team has also raised "Clarification" (CL), where additional information is needed to fully clarify an issue and "Forward Action Request"(FAR) for issues related to project implementation that require review during the first verification of the project activity.

2.1 Document review of PDD and other documents

The initial PDD version 01^{/2/}, additional documents related to the project design and baseline submitted by PP were reviewed as an initial step of the validation process. The subsequent step involved the identification of corrective action requests and clarification requests (CAR and CL) which are presented in Table 3 of Appendix A of this report. As a result of these findings, the PDD was revised by client to version 02^{/3/} and 02.1^{/4/}.

A complete list of all documents and records reviewed is as attached in Section 6.0 of this report.

Significant changes between the PDD version 01 (dated 15/02/2010) published for the global stakeholder comment period and the final version 02.1 (dated 10/02/2012) submitted for registration are as follows:

- Annual estimation of emission reductions in tonnes of CO_{2e} has changed from 419,759 to 310,194
- Section B & relevant sections have been changed to indicate the latest and active version of methodology and tools used
- The chronological list of events has been revised to reflect in more detail the continued and real actions taken by the PP to ensure CDM status of the proposed project till date (i.e. until RFR)
- The investment analysis especially the benchmark analysis and sensitivity analysis have been changed in the revised PDD as per the latest guidance i.e., EB 62, Annex 5
- Section B.6 of the PDD has been revised, the EF_{PF,GR,j,y} is taken now from 'The Study of emission factor for an electricity system in Thailand 2010' published by the host country DNA and auxiliary consumption included in calculations
- Monitoring Plan in section B.7 of the PDD has been revised to include the process diagram of the project activity indicating monitoring equipments, QA/QC procedures and Emergency Preparedness Plan
- Crediting period start date in section C.2.2.1 has now been changed to 15/05/2012.

Further, based on the "Information and reporting check comments on 24 May 2012" the changes between the PDD version 02.1 (dated 10/02/2012) and PDD version 03 (02/11/2012) now submitted for registration are as follows:

- The electricity balance and steam balance of the project activity plant are now included in detail in the PDD and the names of customers buying electricity and steam buyers are also given in the PDD.

- For the applicability condition i.e., criteria 3 and criteria 4, changes are done in accordance with the applicable methodology (i.e., AM0048 version 03) in the PDD.
- Description of the project boundary, monitoring plan is updated in response to the comment.
- The emission factor of grid is revised and emission reduction calculation is changed in the PDD and emission reduction calculation sheet. (i.e., the annual estimation of emission reductions in tonnes of CO_{2e} has been changed from 310,194 to 261, 393)

2.2 Follow-up interviews

SIRIM QAS Intl. had conducted visits to client's head office and project site from 18th to 19th April 2011, to confirm selected information and to resolve issues identified in the document review. The table below provides a list of all persons interviewed and the main topics covered.

NAME	ORGANISATION	TOPICS
Mr. Wuttichai Chanapiyangkoon	Member of the Board of Directors, IRPC Thailand	<ul style="list-style-type: none"> ➤ General information about the project. ➤ CDM consideration. ➤ Financial analysis, project barrier and additionality.
Mr. Suksawat Athipunyapun Mr. Jaruwat Singsomdee	Specialist, IRPC, Thailand Division Manager, IRPC, Thailand	<ul style="list-style-type: none"> ➤ General information about the project & the PDD ➤ Baseline determination ➤ Monitoring and management ➤ Financial analysis, project barrier and additionality ➤ Stakeholder consultation ➤ Operation and maintenance procedures
Mr. Satish Kashyap Mr. Pravin Jadhav	Director, General Carbon Advisory Services Pvt. Ltd. Associate Vice President, General Carbon Advisory Services Pvt. Ltd.	<ul style="list-style-type: none"> ➤ General information about the project & the PDD. ➤ Baseline determination ➤ Monitoring and management. ➤ Financial analysis, project barrier and additionality. ➤ Stakeholder consultation
Mr. Pravet Assavadakorn Mr. Peerasith Inthong Mr. Sirimet Leepagorn Ms. Nawaporn Ploypakdee Mr. Chaidaen Harnwaree Mr. Benjaphol Tangsripairoje	Executive Vice President, IRPC, Thailand Vice President, IRPC, Thailand Vice President, IRPC, Thailand Senior Engineer, IRPC, Thailand Caprolactam Plant Manager, TCL, Thailand Plant Manager, TSR, Thailand	<ul style="list-style-type: none"> ➤ Operation and maintenance procedures ➤ Training. ➤ Calibration and maintenance of monitoring & measuring equipment. ➤ Potential risk and the emergency procedures

Mr Issares Yimtragool	Stakeholder (Resident of Rayong City)	<ul style="list-style-type: none"> ➤ Stakeholder meeting agenda ➤ Members present ➤ Issues raised ➤ Replies of the PP
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2.3 Resolution of Clarification and Corrective Action Requests

The objective of this phase of the validation is to resolve the request for corrective actions and clarification and any other outstanding issues which needed to be clarified prior to SIRIM QAS Intl. positive conclusion on the project design. Thirteen (13) Corrective Action Requests, fifteen (15) Clarification Requests and one (1) Forward Action Request raised by SIRIM QAS Intl. were resolved during communication between the client and the validation team. In order to ensure the transparency of the validation process, the concerns raised and responses that have been given are summarized in Section 2 of this report and documented in more detail in the Table 3 of the validation protocol in Appendix A.

2.4 Internal quality control

SIRIM QAS Intl. has established an internal quality control process. A Technical Reviewer has been appointed to review the final draft validation report and the final validation report. The comments made by the Technical Reviewer have been taken into consideration and incorporated in the final report.

The final report (after resolutions of all findings) was then submitted to the CDM Quality Manager for review and approval.

3.0 VALIDATION FINDINGS

This section summarises the main issues that were found during the validation process. A detailed listing of all findings is available in table 2 and 3 of the validation protocols (Appendix A of this report).

3.1 Participation requirements

IRPC is the project participant and the host country is Thailand. Thailand ratified the Kyoto Protocol on 28th August 2002 and meets the participation requirements of the CDM.

Further, the participation requirements were validated based on the confirmation of the following:

- The project participant is listed in section A.3 of the PDD.
- The information is consistent with the contact details provided in Annex 1 of the PDD.
- The participation of the project participant has been approved by the host party (Thailand) involved, as confirmed in the letter of approval.
- No entity other than that approved as project participant is included in the relevant sections of the PDD.

During the on-site validation, the written Letter of Approval (LoA) from the host country DNA i.e. Thailand Greenhouse Gas Management Organization (TGO) was made available.

The LoA has been verified to be unconditional with respect to the above confirmed aspects. The LoA (Ref. No. TGO No. 02/777 dated 09th December 2010)^{/5/} was verified from "Thailand Greenhouse Gas Management Organization (Public Organization)" website, where the details were listed on page 4 of 6 under the section "Thailand CDM projects which approved and received LoA" (http://www.tgo.or.th/english/index.php?option=com_content&view=article&id=2%3Aapproved-LoA)

[projects&catid=32%3Athailand-cdm-projects&Itemid=46&limitstart=3](#). It was found to be correct and in compliance with para 54 of VVM.

The validation team does not doubt the authenticity of the letter of approval. During the course of the validation, the audit team found no evidence to question the authenticity of the letter provided by the PP and considers that the content of the letter complies with paragraphs 45-48 of the VVM.

The LoA was reviewed and confirmed the following:

- Thailand is a party to the Kyoto protocol
- CDM is a voluntary participation,
- The project under validation will assist in Thailand's sustainable development (SD),
- The project title is in line with the title mentioned under section A.1 of the PDD.

The LoA has been verified to be unconditional with respect to all the above confirmed aspects, complying with para. 49, 50 and 125 of the VVM.

A statement of Modalities of Communication (MoC) with the EB and UNFCCC secretariat has been issued and signed by authorized person of IRPC^{6/}. The MoC, (latest version 1.4) was found to be appropriate as it clearly defined the responsible parties for communicating with the EB and UNFCCC regarding the issuance of CER of the proposed CDM project.

3.2 Project Design

The project document uses the latest CDM-PDD template version 3 which is, currently applicable and hence acceptable. Heading/logo, format/font follows the standard's requirements. The corresponding sections of the PDD are correctly filled in accordance with the guidelines specified (CDM-PDD version 7, (http://cdm.unfccc.int/Reference/Guidclarif/pdd/PDD_guid04_v07.pdf), complying with para. 56 of VVM.

The current project activity of IRPC involves the construction and operation of a new natural gas based cogeneration (combined heat and power) plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid. The power plant will comprise of 6 units of gas turbine generators (GTG) and 6 units of heat recovery steam generators (HRSG). The total installed capacity of the project activity plant will be 227.832 MW (6 units x 37.972 MW) and 408.498 TPH (6 units x 68.083). Out of the six gas engines, one unit of 37.972 MW will be always on standby, thus the available capacity for use is $37.972 \times 5 = 189.86$ MW. Similarly, with one HRSG in standby, the available steam production capacity will be 340.42 TPH. The project is expected to generate and displace 189.86 MWh of electricity annually from the power deficit, fossil fuel dominated regional grid of Thailand, thereby contributing to GHG emission reduction of 2,613,930 tCO₂ over a period of 10 years and contributing to climate change mitigation efforts.

1) Electricity balance of the project activity plant

The project activity has six numbers of 37.972 MW gas engines and one will be on standby. Thus, the available capacity for use is $= 37.972 \text{ MW} \times 5 = 189.86$ MW. After accounting 5.5 MW auxiliary demands (taken from Performance Guarantee for the project activity plant given by the EPC contractor), the net electricity available will be 183.40 MW.

As discussed in the Section B.6.3 of the PDD, 'In baseline, 100 MW was imported from the grid. In the post project scenario, out of 183.40 MW generated from the 5 GTs, 103.864 MW will be used for captive consumption in IRPC, 65 MW will be sold to grid and rest ~ 17.5 MW will be sold other customers (nearby manufacturing plants).'

At investment decision, the project plan was to get 210 MW output. From this, displacement of grid import for captive consumption will be 104 MW, 63 MW for sale to grid, 32 MW for future increased

demand planned expansion of production plant and remaining 11 MW for sale to customer. Thus, the financial model for additionality is as per this scenario at investment decision. For the sale to customers, same electricity tariff is assumed as that of revenue /kW saved from the increased captive consumption. These electricity tariffs rate 2.79 THB/kWh, which is taken from the HT tariff of the PEA for purchasing electricity for industrial used. This will not impact additionality as the actual tariff paid by customers is also determined at same rate as that of the PEA's HT tariff.

The validation team has validated the electricity import from grid by IRPC in the pre-project scenario using the three years historic data as below. This data was verified from the annual reports of the company^{9/} (<http://irpc.listedcompany.com/misc/ar/AR2007EN.pdf>). and data records in SCADA system for past three years.

Year*	2009	2008	2007
Imported electricity from grid by IRPC (MWh)	8,99,639	8,53,911	9,16,788

Note: * January to December

Table showing project customers agreements for electricity supply

No.	Customer name	Contracted demand as per electricity supply agreement (MW)	Whether customer is a group company/ unit owned by PP (yes/ no)
1	Thai Caprolactum Public Company Limited, Rayong (TCL)	10.1	No
2	Thai Synthetic Rubbers Company Limited, Rayong (TSR)	7.4	No

The validation team had reviewed electricity supply agreements (PPAs^{6.1/}) of these project customers and confirms the electricity balance presented.

To summarize, the total electricity balance of the project activity from 189.86 MW plant is as below

User	Auxiliary consumption of plant	Captive demand of PP to replace grid import	Export to grid	Sale to TCL	Sale to TSR	Total
MW	5.5	103.46	63	10.1	7.4	189.86

2) Steam balance of the project activity plant

The project activity will have six units of 68.083 TPH individual capacity HRSGs, thus, total steam generation capacity is 408.498 TPH (6 units x 68.083). Further, similar to gas engines, with one HRSG in standby, the available steam production capacity will be 340.42 TPH.

The distribution of this steam capacity is

No.	Steam demand for entity	Steam requirement (TPH)	Whether IRPC group company
1	IRPC – existing process plant	320.5	This is the PP
2	IRPC – additional steam demand for expanded capacity/ new process plants	9.92	This is the PP
3	Customer 1 - Thai Caprolactum Public Company Limited, Rayong (TCL)	5	This is neither PP nor a group company of PP
4	Customer 2 - Thai Synthetic Rubbers Company Limited, Rayong (TSR)	5	This is neither PP nor a group company of PP
Total		340.42	

The existing steam demand of IRPC was confirmed from three years historic steam use records [SAP (Systems, Applications and Products in data processing software) data from July 2008 and steam generation database (SGDB) report].

The validation team confirmed the steam sale plan for the listed customers TCL and TSR during interviews with management.

The project activity is located at the IRPC Industrial Estate in Rayong, Thailand. The geographical coordinates of the project activity plant are 101°18'44.56" E and 12°39'26.49" N. The location of the proposed project activity was physically verified during the on-site visit and the geographical coordinates of the project activity as mentioned in the PDD were cross checked with globally accessible satellite based imagery data software and found to be consistent. The commercial operation date (COD) of the project was verified during the site visit to be 21st January 2011^{7/}. This was the date when Unit 3 was commissioned, the first among the six units in the project activity to be commissioned.

As per the scopes of the project activity listed in the "List of Sectoral scopes" (Document CDM-ACCR-06 Version 04)', the project activity falls under sectoral scope number 1, – Energy industries (non-renewable sources) as the project activity is a new cogeneration facility supplying electricity and steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels.

This power plant operating on a comparatively cleaner fuel natural gas will lead to lower carbon dioxide emissions for producing equivalent amount of power using carbon intensive fossil fuels like coal and will help in reducing the carbon intensity and power deficiency of the regional grid of Thailand.

The PDD and other relevant documents such as supply agreement for six units of FR6B turbine generators - PG6581B with Nuovo Pignone S.p.A^{8/} were verified and confirmed that the project activity capacity is 227.832 MWh. It has also been verified through the PDD, version1, dated: 15th February 2010 submitted to the DNA for host country approval which mentions the capacity of the project activity as 227.832 MWh. Further, all the supporting documents submitted for CDM validation of the project activity such as determination of additionality and the estimation of the CERs, and the physical site verification confirmed the project capacity as 227.832 MWh.

In order to validate the technical specifications of the project activity as mentioned in the PDD, the technical specifications of the equipment were cross verified with the details provided in the notice to proceed to supply agreement for the main units for cogen plant with Nuovo Pignone S.p.A^{8/} and were found to be correct and consistent.

The project's spatial (geographical) boundaries clearly defined in section A.4.1. The projects system (components and facilities used to mitigate GHGs) boundaries are clearly defined in Section B.3 of the PDD. As per the applied methodology AM0048, boundary is defined as including "the site of the project facility(s) and the sites of all project customer(s)".

The CO₂ emissions due to extraction, processing and transportation of fuel outside the project boundary are being accounted for as leakage emissions to calculate the net emissions reduction. Global average value (i.e., 296 tCH₄/PJ) as recommended in the baseline methodology (AM0048, page 16) is used as fugitive methane emissions for leakage calculation.

The present project activity has chosen a fixed crediting period of 10 years, starting from 15th May 2012 or the date of registration of the project activity with CDM EB, whichever is later, compared with the technical lifetime of the project activity taken as 20 years (from the publication of Department of Treasury 'How to depreciate property' pg. 99 <http://www.irs.gov/pub/irs-pdf/p946.pdf>) is considered reasonable. As per EB 50, Annex 15 "Tool to determine the remaining

lifetime of equipment", for gas turbines, above 50 MW capacity, the default value for technical lifetime is 200,000 hours (which is 22 years). As such, the considered technical lifetime of 20 years for the project activity gas turbines is reasonable.

The validation team has verified that the project has not received any public funding and/or Official Development Assistance (ODA). The project is a unilateral project and has considered 0.8:1% debt to equity ratio as evidenced from the total corporate debt available during the investment decision year from the Annual Report of 2007^{9/} (<http://irpc.listedcompany.com/misc/ar/AR2007EN.pdf>).

The project design is sound and reflects good engineering practices. The project activity once operational will replace the existing oil based furnace steam 480 TPH and about 100 MW electricity imported from the grid. The project is expected to displace 227.832 MW of fossil fuel dominated energy from regional grid, which is equivalent to 261, 393tonnes of CO_{2e} per annum.

Complying with para 64 of VVM, the validation team hereby confirms that the project descriptions and project design in PDD were accurate and complete based on the document review, on-site inspection, physical verification and Interviews conducted.

In this section, 8 corrective action requests (CAR 1, 2, 3, 5, 8, 10, 11 and 12) and one clarification request (CL 1) were raised with details as follows:

- i. The technical/operational lifetime of the equipment mentioned in Section A.4.3 had not been substantiated with relevant evidences (CAR 1).
- ii. The Operation and Maintenance (O & M) agreement documents had not been submitted to the DOE (CAR 2).
- iii. The sections A.4.4, B.6.4 and font and font size in page no.29 of the PDD were not according to CDM-PDD guidelines (CAR 3).
- iv. NOC (i.e., Consent to establish/operate) for setting up the project had not been provided to the DOE (CAR 5).
- v. PP to provide documents to support the total project investment details, gas supply agreement, chronology of events documents, EIA report and stakeholders meeting documents(CAR 8).
- vi. The starting date of the crediting period mentioned in section C.2.2 of the PDD was not realistic (CAR 10).
- vii. The procedures adopted for determining the remaining lifetime of the baseline equipment as per the 'Tool to determine the remaining lifetime of equipment' EB 50, annex 15 (CAR 11) had not been documented in the PDD.
- viii. The latest and active version of the tool available on the UNFCCC website (CAR 12) had not been updated in the PDD.
- ix. Clarification was requested on the gas turbine model, unit of the natural gas used in PDD, CER and financial calculation sheets and the details of the project customers (CL 1).

The CARs and CL raised were adequately addressed and satisfactorily resolved and closed as detailed in Table 3, of Appendix A of this report.

3.3 Baseline and monitoring methodology

3.3.1 Applicability of the selected methodology

The 227.832 MW natural gas based cogeneration plant at Rayong uses the latest approved baseline methodology AM0048^{10/} ("New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-

intensive fuels", version 3). The applicability of the methodology has been discussed in section B.2 of PDD and the project fulfills the applicability conditions as below:

1. The project activity is a fossil-fuel-fired i.e., natural gas based cogeneration plant, supplying steam and electricity generated to multiple project customers in the Rayong industrial premises and part of electricity to grid and PP's captive demand i.e., off-grid applications. Hence, para 1 of the methodology is met.
2. The existing furnace oil based boilers being replaced by the project activity have an operational lifetime which is more than the crediting period (i.e., 22 years as on 15th November 2010 as confirmed by a third party i.e., General Maintenance Engineering Co. Ltd.) and are not expected to result in fuel switch due to replacement or major repair. Hence, condition in para 2 of the methodology is not applicable to the proposed project activity.
3. For the customers of steam and electricity reported above (i.e., Section 3.2) the validation team had interviews with the customers and their plant visit/inspection to confirm that the steam requirement was met from IRPC's old (pre-project) steam generation plant and electricity from the grid. The validation team confirms that, the customers did not have their own electricity and steam generation plants presently. Their steam demand was validated from the steam purchase agreements with IRPC^{/10.1/} and electricity demand from the PPAs signed with IRPC. Hence, para 3 of the methodology is met.
4. As discussed and mentioned above (i.e., Section 3.2), the customers of steam and electricity were buying steam from IRPC (generated from fuel oil based boilers) and electricity from grid. Also, both these customers do not have any existing and proposed steam/ electricity/ cogeneration plants. These customers cannot cogenerate steam and electricity currently and in the baseline scenario (i.e., PP and the other project customers do not replace cogeneration in pre-project or baseline scenario). Hence, para 4 of the methodology is met.
5. All the existing units displaced by the project activity are to be scrapped i.e., the equipment displaced by the project activity will not be sold or used for other purposes. Hence, condition in para 5 of the methodology is not applicable to the proposed project activity

The proposed large scale CDM project is eligible under sectoral scope 1 category 1: energy industries and the category (with a total installed capacity of 227.832 MW electricity generation) is justified as a new natural gas based cogeneration plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid project using non-renewable fuel in energy industries. The project applies the approved baseline methodology AM0048 version 03, "New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels". This is in compliance with para 76 of VVM.

The validation team hereby confirms that the selected baseline and monitoring methodology (AM0048 version 03) was previously approved by the CDM Executive Board, and is applicable to the project activity, which complies with all the applicability conditions specified therein. As a result of the implementation of the proposed CDM project activity, there are no greenhouse gas emissions occurring within the proposed CDM project activity boundary, which are expected to contribute more than 1% of the overall expected average annual emissions reductions, which are not addressed by the applied methodology. This is in compliance with para 77 of VVM.

3.3.2 Project Boundary

As per the applied baseline methodology AM0048, V. 03, project boundary includes the site of the project facility(s) and the sites of all project customer(s). Thus, the boundary includes

- the project facility with the new NG based gas turbines – 6 units, HRSGs -6 units and all

- the allied units in the cogeneration plant
- the project customers include (1) IRPC's petroleum complex where the entire steam and significant part of electricity is utilized, (2) the grid to which part of electricity generated in the project facility is sold to, and (3) the manufacturing plants - Thai Caprolactum Public Company Limited and Thai Synthetic Rubbers Company Limited.

The above listed project customers are already included in the boundary and baseline development, emission reduction calculation and parameters to be monitored e.g. $STT_{PU,j,i,y}$, $EL_{PJ,j,i,y}$

The project design is sound and reflects good engineering practices. The geographical area (i.e., the IRPC Industrial Estate in Rayong, Thailand) and the temporal boundaries of the project have been clearly defined. This was verified through physical inspection during the on-site visit and through the commission certificate^{/7/} and Electricity Supply agreement^{/6.1/}.

PP has selected CO₂ as the emission that will take place in the project activity. This emission is accounted for in the project emissions calculations presented in section B.6.1 & B.6.3 of the PDD and validated in section 3.5 of this report. The validation team based on its discussions with PP, O & M personnel's at the power plant and observations during the site visit noted that natural gas is used as fuel. As the combustion of natural gas gives rise to CO₂ emissions, the consideration of this gas as an emission source is regarded as appropriate by the validation team.

The consideration of only CO₂ gas for the baseline emissions is conservative and is in line with the methodology and hence appropriate. In the absence of the project activity, an equivalent of energy generated by the project activity would be produced in the grid. The power plants connected to the grid which is dominated mainly by fossil fuel fired plants and hence, the emissions taking place in the baseline would also be CO₂ emissions.

The validation team confirms that there are no other sources of GHG emissions in the project boundary, other than the CO₂ emissions referred.

The validation team hereby confirms that the identified boundary and the selected sources of gases are justified for the project activity as per the applied methodology (AM0048, version03), which is in compliance with para 79 of VVM.

3.3.3 Remaining lifetime of the equipment included in the project boundary

The energy units being replaced by the project activity have remaining useful lifetime that is more than the crediting period of 10 years (i.e. 22 years as on 15th November 2010) and are not expected to undergo replacement/ repair to result in fuel switch. The residual life time of the baseline boilers is presented in terms of life cycle analysis reports by a third party engineering company 'General Maintenance Engineering Co. Ltd.' This detailed report was assessed by validation team including by a sectoral expert to accept this evidence to be in line with the requirements of EB 22 Annex 2. The submitted third party engineering company 'remaining life assessment reports'^{/10.2/} meets the requirement as per option 'b' of the two approaches in baseline methodology AM0048. (b) The practices of the responsible company regarding replacement schedules may be evaluated and documented (e.g. based on historical replacement records for similar equipment). This being an independent third party engineering company report, the evidence was accepted as credible.

As per EB 50, Annex 15 "Tool to determine the remaining lifetime of equipment"^{/10.3/}, for gas turbines above 50 MW capacity, the default value for technical lifetime is 200,000 hours (which is 22 years). As such, the considered technical lifetime of 20 years for the project activity gas turbines is reasonable.

3.3.4 Baseline identification

The steps taken to assess the requirement given in paragraph 81 and 82 of the VVM are described below:

DOE has checked identification of baseline for the proposed CDM project activity in the PDD, and then the defined scenario that reasonably represented the anthropogenic emissions by sources of GHGs that would occur in the absence of the proposed CDM project activity. It was confirmed that the proposed CDM project activity is construction and operation of a new natural gas based cogeneration plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid. The electricity generated from the project activity would displace an equal amount of grid electricity which was mainly derived from GHG emitting fossil fuel. Therefore, as referred to in Annex 3 of PDD, $EF_{PF,GR,j,y}$ is taken from Electricity Annual Report 2007 by DEDE Department Ministry of Energy, Thailand, (<http://www.dede.go.th/dede/fileadmin/upload/cc/ElcThai110951.pdf>) was reasonably used as baseline for this project.

The PP has selected the most plausible baseline scenario, by using a step wise approach as suggested in the applicable baseline methodology AM0048, through the following two steps:

STEP 1. Identification of alternative scenarios

PP has identified all the reasonable potential alternative scenarios that could provide similar services as the proposed project activity as listed below;

Alternative		Project developer	Project customer	Application of the methodology, it this is the most likely baseline scenario
		Project facilities in the absence of the project activity (CDM)	Electricity and/or heat sources in the absence of the project activity (CDM)	
Historical		No project facility.	Project customer maintains historical characteristics in terms of on-site fuel choice, on-site equipment efficiency, mix of on-site generation and grid purchase (on-site generation capped at self-generation capacity) and on-site generation equipment lifetime (must be greater than the crediting period).	As the lifetime of generation equipment (i.e., 22 years as on 15 th November 2010 as confirmed by General Maintenance Engineering Co. Ltd) are more than the crediting period of the project activity, IRPC can continue with the existing fuel choice, mix of onsite generation and grid purchase. Hence this alternative is applicable.
		No project facility.	Project customer is likely to switch to less GHG intensive fuel in the absence of the project activity (e.g. a switch from oil to natural gas by the project customer in absence of the project activity).	As IRPC was using fuel oil (FO) in the pre-project scenario, it is not likely that PP would not switch to NG in the absence of the project activity (i.e., switch to less GHG intensive fuel). Hence this alternative is not applicable.
Fuel choice is likely to change at the project customers in the absence of the project activity		No project facility.	Project customer is likely to switch to a more GHG intensive fuel in the	PP operates existing coal based energy generation units, so the option of
		No project facility.	Project customer is likely to switch to a more GHG intensive fuel in the	PP operates existing coal based energy generation units, so the option of

			absence of the project activity (e.g. a switch from oil to coal by the project customer in absence of the project activity).	switching to coal could be considered i.e., switch to a more GHG intensive fuel in the absence of the project activity. Hence, this alternative is applicable.
Efficiency is likely to change at the project customers in the absence of the project activity.		No project facility.	Project customer is likely to increase efficiency of its off-grid electricity / steam production in the absence of the project activity (e.g. replacement of boilers, installation of cogeneration equipment, in absence of the project activity).	PP is not likely to increase the efficiency of its off-grid steam generation in the absence of the project activity as the FO based boilers efficiency cannot be increased any further significantly. Cogen equipment would not have been installed in absence of project activity due to availability of grid electricity as in pre-project scenario. Hence, this alternative is not applicable.
		No project facility.	Project customer is likely to decrease efficiency of its off-grid electricity / steam production in the absence of the project activity.	As the project customer, IRPC's industrial complex would not have decreased efficiency, apart from that resulting from the further aging of energy generation units. Hence this alternative is not applicable.
Energy consumption of project customer is likely to change in the absence of project activity		No project facility.	Project customer energy (electricity and/or heat) consumption in the baseline scenario is likely to be different from that of the project scenario.	The IRPC's industrial complex is not undergoing any change (including that in the production capacity). Thus, the energy consumption in baseline and project scenarios will be the same. Hence this alternative is not applicable.

Project customer is likely to be supplied by external sources of electricity/heat in the absence of the project activity		Proposed project activity without the CDM or other external sources of electricity/ heat supply the project customers energy demands.	Project customer is likely to be supplied by external sources of electricity/heat in the baseline scenario.	Proposed project activity could be implemented without CDM. Hence this scenario is applicable. As there is no other energy supplier existing in/ near the PP's premises, the huge steam requirement of the PP and the project customer demand cannot be met. Hence this alternative is not applicable. <u>Not Applicable.</u>
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From the above discussion it is evident that the plausible baseline scenarios identified by the PP are as follow:

1. Project activity (new natural gas based cogen unit) implemented without CDM
2. Continuation of existing scenario – on-site FO based steam generation and for electricity mix of on-site generation and grid purchase
3. Project customer [(i.e., TCL, TSR and grid (energy supplied by more carbon intensive power plants)] could have switched to a higher GHG intensive fuel – coal

The validation team had interviews the customers and visited the plants to confirm how the steam requirement was met from IRPC's old (pre-project) steam generation plant and electricity from the grid. The interviews also revealed that their steam and electricity demand being very low, they did not see any problem in the continuation of buying steam from IRPC and electricity from grid. There is no National policy that requires them to change this practice. Thus, the discussion in the PDD during baseline identification was accepted as appropriate to conclude that these customers will not have any self-generation capacity in future and would have continued as per the pre-project scenario.

The existing FO based boilers cannot be modified to use project activity fuel – Natural gas. Any other liquid fuel (i.e., Diesel, Naphtha) can be used, but the investment analysis will be similar to that of fuel switch from FO (as NCV and price of other fuels will have similar revenue savings as FO). Thus, validation team accepted arguments given by PP for removing this baseline alternative as not practical.

Fuel switch is a legitimate technical option. PP has demonstrated through the investment analysis and has already commissioned the project activity plant after getting necessary legal/ regulatory clearances. Thus, validation team had no doubt that project activity was not permitted by any legal regulations or is not technically feasible.

The project activity will have six units of 68.083 TPH individual capacity HRSGs. Thus, total steam generation capacity is 408.50 TPH. Out of the six gas engines, one unit of 37.972 MW will be on standby, thus the available capacity for use is = $37.972 \times 5 = 189.86$ MW.

The distribution of this steam capacity is

No.	Steam demand for entity	Steam requirement (TPH)	Whether IRPC group company
1	IRPC – existing process plant	320.5	This is the PP
2	IRPC – additional steam demand for expanded capacity/ new process plants	9.92	This is the PP
3	Customer 1 - Thai Caprolactum Public Company Limited, Rayong (TCL)	5	This is neither PP nor a group company of PP
4	Customer 2 - Thai Synthetic Rubbers Company Limited, Rayong (TSR)	5	This is neither PP nor a group company of PP
Total		340.42	

This is same as presented in the revised PDD and the financial analysis calculations.

As per last para on page 3 of the methodology, “Assessing potential for fuel switch: for all project customers, the project proponent should assess the potential of fuel switching under the baseline scenario. The project proponent first determines if fuel changes are technically feasible using existing baseline equipment/processes. Is the existing equipment capable of utilizing more than one fuel, without major capital investment? This can then be verified during project validation. If not, then no additional considerations need to be undertaken in the given project period and it will be assumed the same fuel would have been used as in the past.”

Using the existing equipment, steam generation using FO and electricity from grid can be continued for the crediting period. Further, the existing FO based boilers cannot be modified to use any other fuel. Thus, continuation of existing scenario is a realistic baseline and same fuel would have been used as in the past. The emission reduction calculation is also based on the actual three year fuel use for carbon intensity/ unit energy as per methodology. Both alternatives 1 and 3 require capital investment for these new power plants and thus will not be financially attractive compared to no project scenario option 2 – continuation of existing scenario. Thus, continuation of existing scenario is the baseline scenario and no project scenario being baseline is further substantiated in following Section B.5 by investment analysis using benchmark analysis.

Hence, the baseline scenario is ‘Continuation of existing scenario – on-site FO based steam generation and for electricity mix of onsite generation and grid purchase’.

Based on the project boundary, CO₂ is indicated as the main source of the baseline emissions, the project emissions, which is correct as per the project activity and the applicable methodology.

It is the opinion of the validation team that the methodology is correctly quoted and applied by comparing it with the actual text of the applicable version of the methodology available on the UNFCCC CDM website and the selected methodology is applicable to the project activity. Also, the credible baseline alternatives have been chosen and exclusion of the alternatives has been appropriately justified to arrive at the applicable baseline and the project boundary along with the sources of GHG emissions and activities (baseline and project activity) has been clearly explained. The emission reductions have been correctly calculated based on the applicable formulae and applicable emission factor, which are detailed in the GHG calculations section.

The validation team therefore confirms that the selected baseline scenario reasonably represents what would happen in the absence of the project activity. Assumptions and data used in the identification of the baseline scenario are justified appropriately, supported by evidence and deemed reasonable. The validation team confirms that the identified baseline scenario is the most reasonable baseline scenario for the proposed CDM project activity and meets the requirements of VVM para 87.

In this section a corrective action request (CAR 9), 3 clarification requests (CL 4, 5 and 14) and one forward action request (FAR 1) were raised as follows:

- i. To submit documentary evidence affirming the efficiency of the baseline boilers and the

- project activity boilers with clear demarcation of its unique identity, the steam generation data of all the baseline boilers, residual life time of all the baseline boilers and for O and M per annum shown as 2.8% of the capital cost is required (CAR 9).
- ii. Details of number of operating hours of baseline steam boilers and quantity of oil (FO, propane, diesel and butane) consumed by the individual boilers during its operation is to be provided. (CL 4).
- iii. Further clarification on the pre-project scenario and project boundary mentioned in the PDD (CL 5).
- iv. Clarification in quantitative terms on the economically most attractive baseline scenario that has been identified as an alternative (CL 14).
- v. For applicability condition no.5, it is mentioned that "The equipment displaced by the project activity will not be sold or used for other purposes. These are either scrapped or retained as stand by units". If used as stand by unit provision must be made for monitoring and capturing under project activity and leakage (FAR 1).

All CAR and CLs were adequately addressed, resolved and closed in revised PDD, version 2.1. The resolution of each CAR and CL is represented in Table 3: Resolution of Corrective Action and Clarification Requests.

3.4 Additionality

The PDD demonstrates additionality through investment analysis and common practice analysis.

The project participant has demonstrated the additionality of the project activity using the investment analysis, as stated in step 2 of the latest version of the additionality tool^{/11/}.

The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that in cases where the project has more than one potential developer, the benchmark shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Accordingly, the weighted average cost of capital applicable to the project type has been considered as the benchmark.

The internal rate of return (IRR) on investment as financial indicator is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. In the proposed project activity, even the IRPC Corporate Planning Guidance^{/12/} had also recommended the use of project IRR as the suitable financial indicator for the evaluation of investment. Thus, the financial indicator chosen is the internal rate of return of the project (IRR). This is compared with the cost of financing which has been taken from the Weighted Average Cost of Capital (WACC).

As per paragraph 12 of the guidance to investment analysis (EB 62, Annex 5), the weighted average costs of capital (WACC) is the appropriate benchmark for project IRR.

Benchmark calculations (i.e., WACC calculations)

WACC is not calculated based on company's internal returns (to follow para 13 of same Guidance), but taken from public available data on market returns (for three years) and performance of six energy companies. Following formula is used for WACC calculation:

$$WACC = W_d * K_d (1-t) + W_e * K_e$$

Where;

W_d = % debt

K_d = interest rate

t = tax rate

W_e = % equity

K_e = return on equity

Cost of equity in this is calculated using default ROE give for Thailand i.e. 11.2% and adding five year average inflation (3.1944%). Thus, the default ROE is 14.3944%.

Inflation projection (IMF)

<http://www.imf.org/external/pubs/ft/weo/2011/02/weodata/weorept.aspx?pr.x=70&pr.y=5&sy=2007&ey=2013&scsm=1&ssd=1&sort=country&ds=.&br=1&c=578&s=PCIPCH&grp=0&a=>

No.	Year	Inflation rate
1	20	5.468%
2	20	-0.846%
3	20	3.272%
4	20	4.006%
5	20	4.072%
Average		3.194%

COE calculations

K_e = (Default ROE + avg. inflation)
= 11.2 + 3.1944

Nominal = 14.3944%

The K_d is taken from average loan rate of commercial banks in Thailand on 18/06/2007 (http://www.bot.or.th/English/Statistics/FinancialMarkets/Interestrates/layouts/application/interest_rate/IN_Rate.aspx).

The tax rate is taken from The Income Tax Act, 2006 (<http://pages.stern.nyu.edu/~adamodar/pdfiles/articles/KPMGtaxratesurvey.pdf>, pg. 20), applicable rate in Thailand.

The W_e and W_d : Thai power sector reforms 2005 (National Energy Policy Council Resolution of 17 October 2005) recommended a maximum D/E of 1.5 for the state utilities equivalent to 40% debt. However, established companies get up to 90% debt (World Bank paper, pg. 3).

The WACC works out to be 13.5% and the detailed benchmark calculations are presented in the benchmark Excel sheet^{13/}.

The cost of equity default value (11.20%) expressed in percentage in real terms for Group 1 projects [Sectoral Scope -1. Energy industries (renewable sources)] of Thailand was chosen from Appendix A of EB 62 Annex 5 was found correct. As the investment analysis is carried out in nominal terms, PP has converted the real term values to nominal values by adding the inflation rate.

Information from the central bank of the host country on the inflation forecast and the target inflation rate for the duration of the crediting period is not available. The inflation rate is taken from the average forecasted inflation rate for the host country (Thailand) published by the IMF (International Monetary Fund World Economic Outlook) for the five year period after the start of the project activity (i.e., 2008 and 2012).

Financial Indicator – Project IRR

The PP has used the following assumptions for investment analysis as per the information

available at the time of project decision making (19th June 2007).

Table: Techno-economic parameters of the implementation of new natural gas based cogen unit

Parameter	Value & Unit	Reference	Justification
Installed Capacity	227.832 MW by GTs 408.498 TPH steam by HRSGs	Detailed technical and financial investigation by internal set up committee ^{/14/} .	The project capacity was confirmed from the "Detailed technical and financial investigation of combined heat and power project" (dated 23 rd April 2007) by internal committee of IRPC. The source is appropriate as it was the only document available to PP at the time of investment decision.
Total Investment	223.89 Million USD	Estimate based on quotes for GE turbines and consultancy with EGAT (proposal dated 12/03/2007) ^{/15/} .	Reflects realistic value from the internal committee constituted by the Board of Directors for the financial analysis. It shows a project cost of 212 million USD and the same is used for the investment analysis presented in the PDD. This is also further confirmed by the PP's Annual Report ^{/9/} in the investment decision year which shows a cost of about 200 million USD (This is a different value from that in the internal committee's report as it excludes Interest During Construction (IDC) and other soft costs, rounded off for generic presentation in the report). Electricity Generation Authority of Thailand (EGAT - a Govt Company) was involved in the process of costing – refer to page 10 of proposal from EGAT ^{/15/} . The project cost referred there is 2 x 4030 million Baht (which at 36 Baht/ USD is equivalent to USD 223.89 million). This is used now for the investment analysis. To substantiate the conservativeness, a sensitivity analysis has been done as per EB guidelines (para 20 of EB 62, Annex 5). The investment cost was taken from earlier similar offer from same supplier evident from a 'proposal to provide technical advisor services for the project

			<p>activity by The Development Group, Electricity Generating Authority of Thailand^{/15/} – a Government agency. This is dt. 12/03/2007 and mentioned an estimated project cost of 2 x 4,030 million Baht (which at exchange rate of 36 Baht/USD is 223.89 million USD). This cost was used in the financial analysis.</p> <p>The validation team further checked actual implemented project cost at the time of site visit and this was 7,858 million Baht. This value is 2.5% lower than the project cost estimated at the investment decision. The sensitivity of -10% is also presented already to cover this lower cost.</p>
Debt/ Equity ratio	0.8:1 Million USD	Standard assumption based on total corporate loan in 2007 ^{/16/} .	<p>As per the investment decision year (as evident from the Annual Report, pg. no. 56) debt/equity in 2007 is 0.45 i.e., $(0.8/1.8) = 0.4444$). The report is available online at web link http://irpc.listedcompany.com/mis/c/ar/AR2007EN.pdf</p> <p>Hence the D/E ratio considered for the project activity is appropriate and standard practice for power projects.</p>
Equity	117.8 Million USD		
Debt	94.2 Million USD		
Life of Project Activity	20 Years	GE turbine specifications ^{/17/}	<p>Compared with the technical lifetime of the project activity taken as 20 years (from the publication of Department of Treasury 'How to depreciate property' pg. 99, http://www.irs.gov/pub/irs-pdf/p946.pdf) is considered reasonable.</p>
Maintenance cost per annum	4% of the capital cost	Estimate based on existing cogen plant operation ^{/18/}	<p>Based on actual operational history of an existing power plant using similar technology within the PP's Group of companies, the value used here was considered conservative. Thus, the O & M cost used is from readily available source of reference, which is appropriate and conservative.</p>

			<p>The project activity was not implemented fully during the validation site visit. Thus, it could not be cross checked with the actual O & M cost. However, PP had presented an estimated break up including chemicals for water treatment (for water to be fed in HRSG), salaries of O & M team and admin support, materials and spares required etc. This value was in close agreement with the estimated 4%^{/19.1/}.</p> <p>A published research paper from GE Power Generation 'Operation and Maintenance Strategies to Enhance Plant Profitability'^{/19.2/} which recommends O & M cost can range from 7%-15% of the operating cost.</p> <p>Further, in sensitivity analysis, if the O & M cost is changes by - 86%, still the IRR does not cross benchmark. Based on these evidences, validation team concludes that the O & M cost used for additionality demonstration is conservative.</p>
Depreciation Rate (Straight Line Method basis)			
Civil Works	5%	Standard practice (SLM over 20 years).	The rates have been applied correctly based on the source applicable at the time of investment decision.
Plant and Machinery	5%		
Depreciation up to (% of asset value)	90%	No special depreciation rates as per Thai Tax laws	
Income Tax		Board of Investment of Thailand Privilege http://www.boi.go.th/index.php?page=boi_zoning	
Working capital			

The project IRR is 7.64% which is less than the benchmark returns of 13.50% and the project is not viable without CDM. With CDM revenue, the project IRR improves to 14.05%. The detailed IRR calculations are presented in the project IRR Excel sheet^{/19/}.

The validation team has confirmed that the values assumed / applied have been sourced from authentic document / references which were cross checked and found to be appropriate, conservative and correct.

Based on the calculations it has been established that the credible options available at the time of investment decision are financially more attractive, compared to the least polluting but more expensive option which is the project activity. The project activity is concluded to be additional and the revenues from CERs will help in making the project viable.

Out of the three alternatives,

- (1) project activity implemented without CDM,
- (2) continuation of existing scenario and
- (3) switch to higher GHG intensive fuel –coal,

The option 2 does not require any additional capital (as evident from the remaining life assessment of existing boilers for steam generation and can continue to be purchased from the grid). Thus, this is the most financially attractive option. The alternative (3) switching to higher GHG intensive fuel was also discussed and ruled out as not realistic. In 2007, the capital cost of a new coal based power plant is reported between \$1,280 to \$1,562/kW [<http://www.naruc.org/grants/Documents/CoalGenerationTechnologies.pdf>, http://www.netl.doe.gov/energy-analyses/pubs/BitBase_FinRep_2007.pdf, http://web.mit.edu/coal/The_Future_of_Coal.pdf (pg. 35)]. The IRR of the alternative – continuation of existing scenario cannot be calculated as without capital investment the IRR calculation attempt gives error.

Table showing parameters validated by validation team i.e., price of natural gas, price of FO, sale price of electricity and steam and price of station heat:

No.	Parameter	Source for primary evidence used in validation	Evidence used for data cross check
1	Price of natural gas	A communication with PTT (natural gas supplier) before the investment decision had given price of gas linked with crude oil in Dubai market (\$/BBL) and there is a premium and escalation as per PTT website	Gas sale invoice of PTT before investment decision ^{/19.3/} i.e., PTT's (Petroleum authority of Thailand) sample gas sale invoice to other clients.
2	Price of FO	PTT's Prices Assumption for Corporate Plan	FO sales invoices of IRPC ^{/19.4/}
3	Sale price of electricity	1) for sale to grid – non firm SPP tariff from EGAT 2) sale to customers – PPA between IRPC and the customers	1) Electricity sale bill to EGAT before investment decision ^{/19.5/} 2) Actual electricity sale bill to customers after project implementation ^{/19.6/}
4	Sale price of steam	Steam sale agreements of IRPC with customers	Actual steam sale bill to customers at investment decision ^{/19.6/}
5	Station heat (rate)	2728 MBTU/ Hr Heat rate is used from the communication with the discussions with equipment supplier	Public data on GE turbines and technical specifications in EPC contract ^{/17/}

Sensitivity analysis:

To substantiate the robustness of the results obtained above, the sensitivity analysis has been conducted. In accordance with para 20 of the investment guidance in EB 62, annex 5, the PP has conducted a sensitivity analysis on the financials by varying the parameters which have a bearing of 20% or more on either the project costs or the project revenues and has tabulated the results.

The scenarios considered for the purpose of sensitivity analysis are +10% increase and -10% decrease in investment cost, O & M and price of natural gas. However, for station heat rate and sale price of electricity and steam, a sensitivity of 5% was studied for the following reason;

- Station heat rate is a standard parameter given by the gas turbine supplier and is not likely to change to a large extent. Also, a +10 sensitivity yields too low revenue and no IRR calculation is possible at that value (model gives error) and
- The electricity sale price to grid is decided in the power purchase agreement (non-firm SPV in this case) and electricity and steam sale price to customers is decided by sale agreements and is dependent on fuel price. Thus, this cannot vary independently of fuel price. Considering possible escalation of these prices, the parameter is subjected to sensitivity of 5%

The result of sensitivity analysis is shown below.

No.	Parameter	Project IRR with % variation in parameter		Benchmark
		+10%	-10%	
1	Investment cost	6.39	9.11	13.50%
2	O & M cost	6.71	8.51	
3	Station heat rate (5% variation only)*	1.14	12.13	
4	Sale price of electricity and steam (5%variation only)*	11.55	2.40	
5	Price of natural gas	7.4	7.88	

* sensitivity done for 5% variation only due to above discussed reason

The validation team confirms that the variables and variations of $\pm 10\%$ performed for sensitivity analysis is deemed to be reasonable based on financial expert's experience, which complies with the Guidance on the Assessment of Investment Analysis. The sensitivity analysis proves that the variation range of uncertainty factors could not increase the IRR of the project at least to reach the benchmark.

The investment analysis is presented in a transparent manner and all the relevant assumptions have been provided in the PDD also. The validation team could reproduce the analysis and arrive at the results. The PDD summarises the results of the investment analysis.

The validation team, based on the assessment result by the financial expert engaged, hereby confirms that the assumptions are appropriate, financial calculations are correct and PP has applied all the statutory levies and taxes correctly corresponding to the investment decision date.

The validation team therefore confirms that the project IRR for the project activity without CDM revenue and even with sensitivity analysis does not cross the benchmark.

Thus, as per VVM para108(c), the financial returns of the proposed CDM project activity would be insufficient to justify the required investment and it is observed that even with the benefits of CDM the project is not a favourable option. Hence, the project is concluded to be strongly additional and CDM revenue is considered imperative to bridge the gap between the IRR and the benchmark. During the validation, two corrective action requests (CAR 6 and CAR 7) were raised in this section with details as follows;

- The PP had not performed a sensitivity analysis as per CDM investment guidance (CAR 6).
- Failure to justify and demonstrate the accessible and non-accessible data/information of common practice analysis (CAR 7).

A clarification request (CL 3) was raised for clarification on major issues in financial additionality with respect to the following:

- The selection of approach followed by the PP for the financial analysis needs to be justified.
- The financial indicator chosen for the analysis to be justified in line with the latest investment guidance as issued by CDM EB.
- The project cost, operating hours, selling price, D/E ratio, rate of interest, loan repayment period, natural gas price, and electricity tariff.
- Suitability of the benchmark and IRR calculations,
- To provide URLS / other authentic evidences for values used in financial analysis calculation.

Step 4: Common practice analysis

The common practice analysis has been analyzed based on requirements of the additionality tool. This test is a credibility check to complement the investment analysis and requires an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region.

The region for the common practice analysis has been defined as the host country, Thailand. Hence, the presented region is considered appropriate for the common practice analysis. Projects commissioned prior to 2000 are excluded from analysis. Hence, to complement the investment analysis and to pass the project activity through the credibility test, the following was carried out;

- Find the similar project activities, that are operational (at the time of decision making and to be further conservative at the time of project validation), from a reliable information source that is available in the public database.
- Exclude if any of those that are CDM project activities
- If still some project activities are left, analyze and demonstrate why the existence of these activities do not contradict the claim that the proposed project activity is financially/economically unattractive by pointing out serious changes in circumstances.

A comparison is made to similar NG based cogen projects with capacity range varying from $\pm 50\%$ of the project capacity [In line with the review comments on power project. <http://cdm.unfccc.int/Projects/DB/DNV-CUK1218186379.41/Review/3TJH2TJ7RN4X5NST0Q7FFB1EQVMEKT/display>] (227 .832 MW and 408.498 TPH) i.e., electricity generation between 114 to 341.75 MW and steam generation between 204.25 TPH to 612.75 TPH.

The project activity is selling < 90 MW to the grid and such power plant (sale between 10 to 90 MW) in Thailand are categorized as Small Power Producers (SPP) [Dr. Sukamon Hinchiranan, Ministry of Energy, Thailand. http://www2.dede.go.th/cdm/520126_GridEmission2007.pdf pg. 4]. The EPPO maintains a list of all operating SPPs (Small Power Producers) on the website and only SPP data was analyzed (<http://www.eppo.go.th/power/data/index.html>).

The project activity is a natural gas cogeneration plant for captive consumption and excess electricity sale to grid. Thus, power plants of this equivalent scale in similar investment scenario, installed by refineries in Thailand are analysed for the common practice analysis. Thailand has seven oil refineries and following table summarises the production capacities (http://www.energy.go.th/moen/upload/File/Knowledge/ERE-Thailand_v.En_web.pdf, <http://www.eppo.go.th/power/data/index.html>).

No.	Name of Refinery	Production capacity
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		(thousand barrels/ day)
1	Thai Oil	270
2	IRPC	215
3	ESSO	160
4	PTTAR	145
5	SPRC	145
6	Bangchak	120
7	RPC	17

For the captive power plants, there is no publicly available information/ database. However, as per the experience of PP, most of the refineries in Thailand use fuel oils for generation of steam and part are generated in coal/ oil based cogeneration power plants. There is also large reliance on the purchase of electricity from grid. This situation is also the pre-project scenario even in the case of IRPC which is hosting the CDM project activity power plant. Thus, it can be concluded that there is no similar power plant in the country that has come up at such a scale, using natural gas and under similar investment scenario.

The common practice has been found to be in conformance with para 119, 120 and 121 of the VVM manual 1.2.

The above discussions show that the project activity would not have been implemented in the absence of CDM and is additional. Thus in line with the additionality tool, the PP has demonstrated additionality by investment analysis and common practice analysis. Based on the requirements of para 111 of VVM, the validation team is of the opinion that the project is additional.

a) Common practice restricted to refineries only

The project activity is a grid connected natural gas based cogeneration plant supplying major share of generated electricity and steam for captive consumption of PP's petroleum refinery. The data available on grid connected power plants in Thailand shows more (91.5% of the total installed capacity) electricity only power plants [Total installed capacity of cogeneration plants was 2,602 MW, or equivalent to 8.5% of the total capacity. Electric Power in Thailand 2009, Department of Alternative Energy Development and Energy Efficiency, Ministry of Energy; pg. VI (in pdf file 13 of 61) (http://www.dede.go.th/dede/images/stories/stat_dede/ElectricPowerinThailand2009.pdf)]. These, cannot be compared with the project activity as they do not generate similar services as the project activity (which also generates steam as final product).

Thus, validation team accepted PP's choice of comparing to cogeneration plants and these operate mainly for captive purpose. Other cogeneration plants that are supplying electricity to grid on 'firm-basis' also get different (comparatively higher) tariff structure than the projects operating on non-firm basis. Also, the data on captive power plants is not available publically and financial structure will also vary as in a petroleum refinery like PP will have in house FO/ other fuels whereas other industries will depend on its market sale rate. This has been verified using PP's interviews, DOE's research and sectoral expertise. Thus, DOE has chosen to restrict similar plants to where steam and electricity is used and it is a petroleum refinery. Thus, the common practice analysis was restricted to refineries.

b) No public information on captive plants of refineries

The data on refineries and their captive power plants is not available publically has been verified using PP's interviews, DOE's research and sectoral expertise. For comparison with project, detailed financial data will be required and which was not found in any of the public reports.

Early consideration of CDM:

As per the CDM Guidance (Glossary of CDM terms), the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. Minor pre-project expenses, e.g. the contracting of services /payment of fees for feasibility studies or preliminary surveys, should not be considered in the determination of the start date as they do not necessarily indicate the commencement of implementation of the project (EB 41, Meeting Report, para 67).

The start date of the project activity considered for this project is the date of "Supply agreement for the main units for Cogen plant" with Nuovo Pignone S.p.A on 12th October 2007^{/8/}. This was the date when PP committed to the expenditures for the project activity. It meets the start date definition in CDM glossary of terms (version05) and fulfills the requirements of para 99 of VVM.

Further, the validation team has determined that the project under validation is a project activity with a start date before 02 August 2008 and hence falls under "existing" project activities (based on EB 62, Annex 13 guidelines on prior consideration). The start date is prior to the date of publication of the PDD for global stakeholder consultation and 2nd August 2008. Accordingly, the requirements of early CDM consideration, indicating real and continuous action by PP to secure CDM status in parallel with CDM implementation have been evaluated.

PP has indicated awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project from the following.

1. Internal committee proposes gas based cogen project^{/20/} – 09th February 2007
2. Internal memo for preparation of feasibility report^{/21/} – 20th February 2007
3. Proposal to provide technical advisor services for the project activity by The Development Group, Electricity Generating Authority of Thailand' – a Government agency^{/22/} – 12th March 2007
4. Feasibility report emphasized financial un-viability and recommended securing CDM revenue – Prior awareness – 23rd April 2007^{/23/}.
5. LOI with GE required them to complete the CDM registration process –Minutes of meeting with GE Oil and Gas dated: 25th May 2007^{/24/}.
6. IRPC Board of Directors approved investment of 220.0 million USD for the implementation of project - Extracts of the Minutes of the Board meeting dated: 19th June 2007^{/25/}.

The project participant has indicated that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. The chronology of major activities of the project represented in section B.5 of PDD establishes and corroborates real and continuous action which was verified by means of reliable evidence.

Activity	Time period between consecutive CDM activities
Supply agreement for the main units for Cogen plant with Nuovo Pignone S.p.A on 12 th October 2007 ^{/8/}	Start Date
GTs arrived the IRPC site - 20 th October 2008 ^{/26/}	12 months
EIA approval from Ministry of Natural Resources - 3 rd March 2009 ^{/27/}	4 months
Agreement for supply of Natural Gas – 09 th June 2009 ^{/28/}	3 months
Appointment of the CDM consultants -09 th October 2009 ^{/29/}	4 months

Local Stakeholders consultation meeting -12 th January 2010 ^{/30/}	2 months
Appointment of present DOE – 05 th July 2010 ^{/31/}	5 months
PDD web hosted for GSC – 09 th October 2010 to 07 th November 2010 (http://cdm.unfccc.int/Projects/Validation/DB/YSN6WMVN6FCHIXZ2AE08PRM1WC45T1/view.html)	4 months
Host country approval from NCDMA (TGO) – 26 th October 2010 ^{/5/}	

The validation team verified the evidences for all the events listed in the chronology under Section B.5 of the PDD and it was seen that the PP had initiated and continued to take real action in parallel with the implementation of the project activity and that all the activities from the start date of the project activity until the date of webhosting the PDD for global stakeholder comments were completed well within the time span of 2 years and hence adequately met the requirements as mandated by the guidelines on the demonstration and assessment of prior consideration of the CDM (Ver. 04, EB 62, Annex 13).

In this section a corrective action request (CAR 4) was raised with regard to prior consideration / awareness of CDM before date of the board decision. The CARs raised were adequately addressed and satisfactorily resolved and closed as detailed in Table 3, of Appendix A of this report.

3.5 Monitoring Plan

The project uses approved monitoring methodology “New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels”, AM0048 version 03, which is applicable to the project.

3.5.1 Parameters determined ex-ante

The following parameters were available during the validation and will remain fixed throughout the crediting period:

- 1) As required by the baseline methodology, historical data from the last three years was used for the calculation of historical fuel consumption (i.e., $EL_{GR,i} = 890,113\text{MWh}$). Total amount of electricity obtained from the grid by IRPC during the most recent three years prior to the implementation of the project activity is checked with the bills from Provincial Electricity Authority (PEA). The baseline methodology applied AM0048, page. 10 requires most recent three years data to be used for baseline emissions calculation. The project activity was web hosted for GSC on 09/10/2010 and project activity was commissioned in January 2011. Some gas engine commissioning tests were started in 2010 and phase wise one by one engines were commissioned till January 2011. Thus, 2010 full year data was not available at that time. Thus, most recent three years before that were appropriately accepted as 2009, 2008, 2007.
- 2) Specific enthalpy of steam of existing generating equipment at IRPC prior to the implementation of the project activity (i.e., $EN_{BL,i}$ and $EN_{BL,i,m}$ in TJ/tonnes). This data was obtained from steam tables, using temperature and pressure of the steam measured at the pre-project generating equipment. LPS – 20 bar (lower of range) = 2799.71, HPS – 43 bar (lower of range) = 2800.0.
- 3) Steam pressure (pressure of steam generated by IRPC). Readings were taken directly

from pressure gauges daily and averaged monthly. The log book record of the readings of the pressure gauges at IRPC, were verified during the site visit and they were observed to be 20-25 bar for LPS, 43-46 bar for HPS.

- 4) As required by the baseline methodology, the last three year's historical data was used for the calculation of historic fuel consumption (i.e., $F_{ST,i,fuel\ oil}$ in ton). Quantity of fuel oil consumption by IRPC to self-generate steam during the most recent three years prior to the implementation of the project activity was taken from the SAP data from July 2008 and SGDB report prior to July 2008.
- 5) $GC_{EL,i,n}$ (in MW), the capacity of the electricity generating equipment 'n' existing at IRPC prior to the implementation of the project activity. Data was taken from the O&M manual and from the nameplate of the turbine generators. No cogen existed in the project boundary in pre-project scenario, so the value is zero.
- 6) $GC_{ST,i,m}$, the capacity of the steam generating equipment 'm' existing at IRPC prior to the implementation of the project activity. Data was taken from the nameplate of the turbine generators i.e., 450 ton/ hour. The breakup of individual boiler capacities is indicated in section A.4.3 of PDD.
- 7) As required by the applicable baseline methodology, the last three years historical data was used for the calculation of historic fuel consumption, $H_{ST,i,k}$ (in Ton), i.e., steam generation by IRPC with fuel k during the most recent three years prior to the implementation of the project activity. Data was taken from SAP from July 2008 and SGDB report prior to July 2008.
- 8) $MDH_{ST,i,m}$, Normal maintenance and down time hour of the steam generating equipment 'm' existing at the project customer 'i' prior to the implementation of the project activity. Data for power plant performance indices report for boiler 05 and shutdown record for LUT & UT1 boilers were taken from maintenance logs of the power plant. As multiple boilers have different durations, the hours of steam generation is indicated separately in Annex 3 of the PDD.
- 9) $\eta_{ST,i,k}$ (in TJ/TJ), Fuel consumption rate of self-generation of steam at IRPC, with fuel 'k'. Default value provided by CDM Methodological tool is used (85%). The methodology has given three choices and choice of data is presented in the PDD, page no. 28. The PP has shown different efficiencies for individual pre-project boilers through data records for three years. This varied from 75-85%. As per sectoral expertise, the most existing liquid fuel boilers have average efficiency ~ 85%. Thus, the default value suggested by the 'Tool to determine the baseline efficiency of thermal or electric energy generation systems, V. 01, EB 48, Annex 12'^{32/} was accepted as conservative. This approach was found to be in line with the methodology option i) Highest of the measured fuel consumption rate of electricity generating equipment with similar specifications.
- 10) Net calorific value of furnace oil fuel ($NCV_{FO} = 0.0404$ TJ/Ton), 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Vol. 2, Ch. 1, Table 1.2, pg. 1.18). As this is a third party measured and given value for commercial purpose, PP has used this value for the emission reduction calculation.
- 11) Emission factor of fuel oil $EF_{CO_2,fuel\ oil}$ (77.4 tCO₂/Ton), as there in no project specific data available to the PP, PP has used the default value recommended by IPCC (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, pg. 1.23) for all hydrocarbon oils used in the project activity, in line with the applied methodology AM0048.
- 12) CO₂ emission factor of the grid connected to the IRPC in year 'y' ($EF_{PC,GR,i,y} = 0.5113$

tCO₂/MWh). The emission factor is estimated using the procedure described in the latest version of approved "Tool to calculate emission factor for an electricity system" making $EF_{PC,GR,i,y} = EF_y$. The $EF_{PF,GR,j,y}$ is taken from 'The Study of emission factor for an electricity system in Thailand 2010' published by the host country DNA. This value is fixed and will be used throughout the crediting period.

PP had discussed practical difficulty in maintaining customer side metering and monitoring requirements. Thus, the steam pressure and temperature at the nearest point to these customers (common steam header) and which is within the SAP system of PP under the project activity was chosen. The steam sale invoices also do not mention steam quality used at the customers end but only the quantity in ton.

Now, PP has also modified the monitoring plan to include both customers to measure steam quantity and quality (temperature and pressure). Thus, the monitoring plan will now result in accurate emission reduction calculation. The electricity balance and the share of both customers are also updated in the modified PDD now. The electricity records will be cross checked with the electricity sale invoices of the customers and this is already mentioned as a QA/QC measure for parameter $EL_{PJ,i,y}$.

The ex-post emission reduction calculation is now revised based on calculated emission factor available at the time of submission of the CDM-PDD to the DOE for validation. The electricity balance and the share of both customers are given in the modified PDD. The emission factor of grid is revised and emission reduction calculation is changed in the PDD and emission reduction calculation sheet.

Validation team has verified the value used against the sources and concluded that the data used are appropriate and conservative.

3.5.2 Parameters determined ex-post

The baseline and project emissions parameters that are to be monitored ex-post are indicated in Section B.7.1 of the PDD and as follows

1. Carbon emission factor of fuel 'k' used by project facility 'j' to self-generate electricity in the baseline scenario ($CEF_{j,k} = 77.4$ tCO₂/MWh). As there is no project specific data available to the PP, PP has used the default value recommended by IPCC (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, pg. 1.23), as suggested by the applied methodology AM0048 and monitored annually.
2. Carbon emission factor of natural gas used by project facility to generate electricity in the project activity scenario ($COEF_i = 56.1$ tCO₂/MWh). As there is no project specific data available to the PP, PP has used the default value recommended by IPCC (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, pg. 1.24), in line with the applied methodology AM0048 and monitored annually.
3. Emission factor for upstream fugitive methane emissions from production, transportation and distribution of natural gas ($EF_{CH_4,ups,k} = 296$ tCH₄/TJ). As suggested by the baseline methodology AM0048 (V. 03, pg. 15), IPCC default Tier 1 emission factor is used for calculation and monitored annually.
4. Emission factor for upstream CO₂ emissions due to fossil fuel combustion /electricity consumption associated with the liquefaction, transportation, regasification and compression of LNG into a natural gas transmission or distribution system ($EF_{CO_2,ups,LNG} = 6$ tCO₂/TJ). IPCC default Tier 1 emission factor as suggested in the baseline methodology AM0048 (V. 03, pg. 16) is used for calculation.

5. Total electricity self-generated by IRPC during year 'y' of the crediting period (MWh), will be monitored continuously using, electricity meter ($EL_{PCSG,i,y}$ MWh). Data will be directly recorded in the SAP (Systems, Applications and Products in data processing software for automatic data recording). Crosschecking with purchase receipts and electricity supply data at project site will be carried out. The electricity meter with accuracy class of 0.5s% will be calibrated once in every two years.
6. Total steam self-generated by IRPC during year 'y' of the crediting period ($SC_{PCSG,i,y}$ in TJ). Steam flow meter at IRPC new power plant will be equivalent to installed capacity in project activity = 408.498 TPH at 20 and 43 bar. Data will be directly recorded in the SAP. Crosschecking with the purchase receipts and steam supply data at project site will be carried out. Steam flow meters will be calibrated once in every two years with acceptable error of 2% (equivalent to accuracy level of meter).
7. Electricity supplied to the grid by the proposed project facility 'j' in year 'y' ($EL_{PF,GR,j,y}$) will be measured continuously using electricity meter that are installed at the dispatch point of IRPC. Data will be directly recorded in the SAP. Crosschecking with sales receipts and electricity supply data at project site. Electricity meters are calibrated once in every two years and accuracy class of the meter is $\pm 0.5\%$. There will be two meters (one for grid and another for sale to nearby customers).
8. Electricity utilized by IRPC and external customers from the proposed project facility 'j' in year 'y' will be measured continuously using electricity meter at the IRPC new power plant. Data will be recorded in the log book. Crosschecking with purchase receipts and electricity supply data at project site. Calibration will be carried out once in every two years.
9. Specific enthalpy of the steam utilised by IRPC and customer 1, 2, 3 and 4 will be obtained from steam tables, using temperature and pressure of the steam. The monitored pressure and temperature of the steam will be used to obtain the specific enthalpy from steam tables. Calibration of steam flow, pressure and temperature meters will be carried out once in every two years.
10. Steam pressure i.e., Pressure of steam utilized by IRPC and customer 1, 2, 3 and 4, will be directly recorded from the steam pressure gauge installed at consumption points and crosschecked with records of common steam header. Calibration is done once in every two years and the accuracy class of the meter is 0.2%.
11. Temperature of the steam utilised by IRPC and customer 1, 2, 3 and 4, will be directly taken from steam temperature indicators. Readings will be crosschecked with records of common steam header. Calibration will be carried out once in every two years, with accuracy class of 2°C.
12. Quantity of LNG consumed in the year 'y' in the project facilities ($FC_{LNG,j,y}$ in m^3) will be taken from the gas flow meter records and fuel usage data logs. Crosschecking with LNG purchase receipts/ invoices will be carried out. However, LNG use is not envisaged in the project activity.
13. Quantity of natural gas consumed in the year 'y' in the project facilities ($FC_{PJ,PF,j,k,y}$ in m^3), will be measured from the gas flow meter at the IRPC new power plant. Data will be directly recorded from the gas flow meter and averaged monthly. Meters shall be calibrated as per their data book once in every three years and the accuracy class of the meter is 2%. Measuring conditions shall be as per meters data book and consistency of the measurement will be checked with the historical monitored data.
14. Net calorific value of natural gas fuel (NCV_{NG}) will be taken from the gas suppliers' invoice

and used directly for the emission reduction calculation.

15. Steam utilized by IRPC and customer 1, 2, 3 and 4 from the new power plant ($STT_{PU,j,i,y}$) will be directly recorded from the steam flow meter at the project activity power plant. Steam flow meters will be calibrated as per their data book once in every two years.
16. Quantity of fossil fuel consumed per fuel type 'k' in the year 'y' in the baseline facilities ($FC_{PJ,BF,j,k,y}$ in m^3). This parameter will be metered in case the standby units are operated during the crediting period. Data will be directly recorded from the mass/ flow meter and averaged monthly at the IRPC existing utilities plant (pre-project). Meters measuring conditions and calibration shall be as per their data book (minimum once in three years) and consistency of the measurement will be checked with the historical monitored data.
17. Net calorific value of fossil fuel consumed per fuel type 'k' in the year 'y' in the baseline facilities ($NCV_{BF,j,k,y}$). This parameter will be calculated in case the standby units are operated during the crediting period. Value will be taken from the fuel suppliers' invoice.
18. Steam utilized by IRPC and customer 1, 2, 3 and 4 from the existing utilities plant (pre-project) ($STT_{PU,j,i,y}$ in Ton). Data will be directly recorded from the steam flow meter at the existing power plant, monthly. Meters measuring conditions and calibration shall be as per their data book and consistency of the measurement will be checked with the historical monitored data. This will be metered in case the standby units are operated during the crediting period and presently the boilers are proposed to be scrapped in the project activity.

Data monitored because of Baseline Scenario Selection/Additionality

19. Future energy plans and investment plans, modernization or investment plans outlining planned upgrades or replacement to any generating unit within the project boundaries will be updated as per the business plan, if any.

Section.B.7 of PDD describes in detail the QA / QC procedures related to calibration, meter testing, internal audits, maintenance of monitoring equipment and monitoring plan implementation which are found to comply with the requirements of the applicable methodology. The O & M is undertaken by the plant personnel appointed by the project proponent.

The grid emission factor has been determined according to the procedures prescribed in "Tool to calculate the emission factor for an electricity system"^{1/33/} using the latest information available at the time of web hosting and reported data was found to be 0.5742 tCO_{2e}.

The emission factor can 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 the 'Tool to calculate the Emission Factor for an electricity system'.

or

(b) The weighted average emissions (in t CO_{2e}/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system'^{1/34/}, as data is available from an official source. In this project activity, Grid emission factor has been calculated and fixed ex-ante. The operating margin has been taken as a weighted average of the available data from the past three year.

Parameter	Value
Operating margin CO ₂ emission factor	0.5532
Build margin CO ₂ emission factor	0.5954
Combined margin CO ₂ emission factor	0.5742

The validation team validated the grid emission factor as per each step of the tool and is of the opinion that the approach to determine combined margin ($EF_{CM,y}$) is in accordance with the applied 'Tool to calculate the emission factor for an electricity system'^{/34/}.

PP has used the official published data on OM and BM emission factors (Published by "Electricity Annual Report 2007 by DEDE Department Ministry of Energy, Thailand", website: <http://www.dede.go.th/dede/fileadmin/upload/cc/EleThai110951.pdf>). The validation team agrees with the use of this emission factor, since it is based on the official background data. Furthermore the PP has provided the CER calculations^{/35/} where the calculations can be assessed and these are found to be correct.

The GHG indicators, parameters, monitoring methods, frequencies and the measurement equipment were considered to be reasonable and appropriate. The parameters monitored will allow the calculation of the baseline emissions in a proper manner. Maintenance and calibration of electricity meters are carried out according to the calibration schedule programmed at the start of the operation. All data will be archived in paper / electronic form until two years after the crediting period.

The CDM coordinator, is the overall responsible project executor and head for the proposed project activity and shall be responsible for the checking the information consistency.

It is the opinion of the validation team that the project complies with para 124 of the VVM 1.2 based on the following

- The monitoring plan is in line with the requirements of the methodology
- Monitoring arrangements described in the monitoring plan are feasible within the project design and
- The PP is able to implement the monitoring plan.

In this section a corrective action request (CAR 13) and 7 clarification requests (CL 2, 6, 7, 8, 9, 10 and 11) were raised with regard to

- i. The calculation of grid emission factor is not clearly demonstrated in the PDD (CAR 13).
- ii. The provisions made by PP for meeting training and maintenance needs (CL 2).
- iii. The values of some of the parameters not provided in section B 7.1 of the PDD and to include accuracy class of all the meters used in the project activity (CL 6).
- iv. In section B.7.2, of the PDD there is no mention of emergency preparedness plan for cases where emergencies can cause unintended emissions (CL 7).
- v. PP was requested to provide the identified procedures for maintenance of monitoring equipments, calibration of equipments and calibration intervals/frequency (CL 8).
- vi. As the project has yet to be commissioned, PP was requested to include process flowchart indicating relevant monitoring equipment and items in section B.7.1 of the PDD (CL 9).
- vii. To include provision for the review of the reported results/data will be done before data is submitted for verification, internally or externally (CL 10).
- viii. To include provision for the identification of procedures for dealing with possible monitoring data adjustments to handle exigency situations (CL 11).

The CAR and CL raised were adequately addressed and satisfactorily resolved and closed as

detailed in Table 3, of Appendix A of this report.

3.6 Calculation of GHG Emissions

As per the applicable baseline methodology AM0048, following step wise approach was used to calculate the emission reduction in the PDD. Furthermore the PP has provided the CER calculations^{/35/} where the calculations can be assessed and these were found to be correct.

Baseline emissions

The baseline emission sources considered are sum of emissions from generation of electricity and emissions from generation of steam.

Emissions for the production of electricity that would be supplied to individual project customers in year 'y' in the baseline scenario. The electricity eligible to certified emissions reductions is limited to the maximum generating capacity of the project customer existing previous to the implementation of the project activity and the maximum generation capacity of the pre-project electricity generating equipment at project customer.

$$BE_y = BE_{IC,y} + BE_{ST,y} + BE_{GR,y}$$

Where:

BE_y = Baseline emissions in year y (tCO_2).

$BE_{IC,y}$ = Emissions for the production of electricity that would be supplied to individual project customers in year y in the baseline scenario (tCO_2).

$BE_{ST,y}$ = Emissions for the production of steam that would be supplied to individual project customers in year y in the baseline scenario (tCO_2).

$BE_{GR,y}$ = Emissions for the production of electricity that would be supplied to the grid in year y in the baseline scenario (tCO_2).

Project emissions (PE_y):

The project emissions from the combustion of fossil fuels to produce steam and electricity at the project facility(s) (PE_y) are calculated using the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". The parameter PE_y corresponds to $PE_{FC,j,y}$ in the tool, where j are the processes that fire fossil-fuels attributable to the project activity. Project emission is calculated as per the following formula.

$$PE_y = FC_{i,y} \times CO_{EFi}$$

As per tool, two options are given viz

Option A-The CO_2 emission coefficient $CO_{EFi,y}$ is calculated based on the chemical composition of the fossil fuel i.e., based on weighted average mass fraction/density of carbon in fuel.

Option B- The CO_2 emission coefficient $CO_{EFi,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type i.

Option A is not used as necessary data is not available i.e., chemical composition is neither measured nor given by gas supplier. So, option B used taking NCV_{NG} and quantity is measured by gas metering. This was verified and confirmed by gas supplier's invoice during site visit. The CO_{EFi} is taken as 56.1 (tCO_2/TJ) which is the default value from 'Table 1.4 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories'.

As the project activity will only use natural gas, and at estimated 2.333 TJ/hr, at planned 8,000 operation hours a year the total $FC_{i,y}$ had been calculated as 18,664 TJ .

$$\text{Thus, } PE = 18,664 (TJ) \times 56.1 (tCO_2/TJ) = 1,047,050 tCO_2$$

Leakage (LE_y):

As per the applied methodology, leakage may result from the extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH₄ emissions and CO₂ emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered:

- Fugitive CH₄ emissions associated with the extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels used in the project plant and fossil fuels used in the grid in the absence of the project activity;
- In the case liquefied natural gas (LNG) is used in the project plant: CO₂ emissions from fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

For the proposed project activity leakage from "Fugitive methane emissions" is considered. Global average value of 296 tCH₄/PJ is used for calculating leakage as recommended in the baseline methodology, AM0048, page 16.

$$LE_{CH_4,y} = 21 \times (18,664 / 1000) \text{ PJ} \times 296 \text{ tCH}_4/\text{PJ} = 116,015 \text{ tCO}_2$$

Emission Reductions (ER_y)

The estimated emissions reduction ER_y by the project activity during a given year y is:

$$ER_y = \text{Baseline Emissions} - \text{Project Emissions} - \text{Leakage},$$

$$ER_y = 1,424,459 - 1,047,050 - 116,015 = 261,393 \text{ tCO}_2\text{e}$$

The measurement of net electricity generated is according to the applied methodology, established in monitoring section and PP has used the official published data on OM and BM emission factors. The version of the data used is as available on the date of validation.

These have been described adequately in section B 6.1 of the PDD and in CER calculation sheet^{31/} as per the methodology AM0048, Version 3. Hence as per VVM 1.2 para 92, it is the opinion of the validation team that

- All assumptions and data used by the PP were listed in the PDD, including their references and sources;
- All documentation used by PP as the basis for assumptions and source of data were correctly quoted and interpreted in the PDD;
- The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions;
- All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.

In this section a clarification request (CL 15) was raised with regard to number of units in the project activity operation (i.e., 6 units or 5 units) considered for baseline emission calculations and to include auxiliary power consumption in the calculations. The CAR and CL raised were adequately addressed and satisfactorily resolved and closed as detailed in Table 3, of Appendix A of this report.

3.7 Environmental Impacts

The project activity is taking place inside the existing industrial complex and within a notified industrial area. An Environment Impact Assessment (EIA) was conducted by Air Save Co. Ltd. in

July 2007^{/36/} as per the guidelines by the Office of Natural Resources and Environmental Policy and Planning (ONEP) under the Environmental Quality Act. It was verified during validation that the EIA had been approved by ONEP.

The significant environmental impacts of the project activity along with the measures taken to mitigate the impacts and the conclusions are enumerated in Section. D of the PDD. As the plant is located in a notified industrial area and the proposed plant will run on natural gas (a clean fuel), it is ensured that there are no major negative impacts envisaged on the air quality, water environment and land environment of the surrounding region. Moreover the plant authorities have taken necessary care to see that all statutory regulations existing in the country are met. The validation team considered that the project will not have adverse environmental impact.

A clarification request (CL 12) was raised for not enumerating in the PDD, the identified environmental impacts of the project activity along with the measures taken to mitigate the impacts and the conclusions. The relevant section in the PDD version 2.1 was modified to include the identified environmental impacts along with the measures taken to mitigate the impacts. Hence, this CL was closed. The resolution of CL is represented in Table 3: Resolution of Corrective Action and Clarification Requests.

3.8 Comments by Local Stakeholders

A local stakeholder's consultation meeting was organized at the project activity site on 12th January 2010. PP had communicated by written invitation^{/37/} 15 days well in advance of the meeting to the identified stakeholders like; the elected representatives of the local residents, neighbouring industries, local residents residing in the neighbourhood villages, Government officials and employees of IRPC. Also, the stakeholders who could not attend the meeting were given the option to send their comments / seek clarification from the contact person chosen by PP for the following 15 days.

The meeting was attended by 34 participants^{/38/} including 8 local administrative officers, 3 representatives of a neighbouring factory, 5 villagers residing near the factory, 1 representative from the Pollution Control Board, 1 representative from local Electric Board; 1 representative from equipment supplier (GE Energy Co. Ltd.), 14 employees from IRPC and 1 CDM consultant.

The meeting started with welcome address, election of chair and this was followed by a brief presentation on climate change, the Kyoto Protocol, CDM and the role of the project activity in sustainable development. The stakeholders were then invited to comment / seek clarification on the project activity.

The main concerns of the stakeholders were with regard to the location of the project, commissioning schedule, NG supply, odour of NG and benefit to the local community. The stakeholders were given clarification on the issues raised to their satisfaction by providing relevant evidence of the project claims. There were no specific comments that required follow up action from CDM project activity point of view as evident from the minutes of the stakeholder meeting^{/35/} and the description provided in Section E of the PDD.

The information regarding the stakeholders meeting was verified during the site visit by checking the minutes of the meeting^{/39/} and interviewing the relevant member who had participated and was present at the meeting. The interviewed person confirmed the information provided in the PDD and the documents / record of the local stakeholder consultation process.

The consultation process was carried out as per CDM requirements. The validation team hereby confirms that the process of local stakeholder consultation was observed to be adequate.

A clarification request (CL 13) was raised on the PP's reply to the query raised by Ms. Phanumas Wuthiananchai regarding the plant capacity (i.e., 220 MW). The resolution of the CL is represented

in Table 3: Resolution of Corrective Action and Clarification Requests.

4.0 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS

The PDD version 1 dated 15th February 2010 was made available for Parties, Stakeholders and UNFCCC accredited NGOs to comment via UNFCCC website (<http://cdm.unfccc.int/Projects/Validation/DB/YSN6WMVN6FCHIXZ2AE08PRM1WC45T1/view.html>) from 09th October 2010 to 07th November 2010 for a period of 30 days.

There was no comment received during this period.

5.0 VALIDATION OPINION

SIRIM QAS Intl. performed a validation of the proposed CDM project "Natural gas based cogeneration plant at IRPC Public Co. Ltd. Thailand" in Thailand. The validation was performed on the basis of the UNFCCC criteria for the Clean Development Mechanism and the host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting. Using a risk based approach, the review of the project design documentation and the subsequent follow-up interviews provided the validation team with sufficient evidence to determine the fulfillment of the stated criteria.

The project participant is M/s IRPC Public Company Limited. The project is a unilateral project, the party involved and the host country is Thailand. Thailand fulfills the requirements to participate in the CDM. The DNA of Thailand has confirmed that the project assists in achieving sustainable development.

The proposed large scale CDM project is eligible under sectoral scope 1 category 1: energy industries and the category (with a total installed capacity of 227.832 MW electricity generation) is justified as a new natural gas based cogeneration plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid project using non-renewable fuel in energy industries. The project applies the approved baseline methodology AM0048 version 03, "New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels".

The proposed CDM project activity is construction and operation of a new natural gas based cogeneration plant to replace the fossil fuel based captive steam generation and import of electricity from the national grid. Under the project activity, a new natural gas based cogeneration plant is being installed in phase wise commissioning plan. The main purpose of the project activity is to generate electricity through less GHG intensive fuel, such as natural gas (NG), that displaces electricity from an electricity distribution system (Regional Grid) dominated by more GHG intensive fossil fuel fired generating units. The project activity will displace approximately 261, 393 tCO₂e of less carbon intensive CO₂ of power annually to the power deficit, more carbon intensive regional grid.

The project capacity is fixed and no addition will be made in capacity during the crediting period. The project will result in the reduction of greenhouse gas emissions that are real, measurable and give long term benefits to the mitigation of climate change. It is demonstrated that the project faces an investment barrier that would prevent its implementation without the CDM. Without the CER revenue, the project IRR is 9.33% and with the CER revenue is 15.69%. Emissions reductions from the project are hence additional to any that would occur in the absence of the project activity.

The GHG emission calculations are documented in a complete and transparent manner. The formulae and methodologies for accounting GHG emissions are appropriate and emission factors are deemed to be of sufficient accuracy. The total emission reductions from the project as envisaged in the PDD version 03, dated 02nd November 2012 are 261, 393 tCO₂e over the 10-year crediting

period. The emission reductions forecast has been checked and it is deemed likely that the stated amount is achievable on the basis that the underlying assumptions do not change.

The monitoring plan is in line with the approved monitoring methodologies of AM0048, version 03. The plan adequately addresses all necessary information for monitoring and reporting of emissions reductions due to the project activity. Responsibilities and authorities for project management, monitoring and reporting, and the data quality control and quality assurance procedures have been described in the PDD are implemented.

An Environmental Impact assessment (EIA) for the project activity has been conducted. The plant has been granted with the environmental clearances and consents as per the requirements of the regulatory authority of the host country. The project is not likely to create any significant adverse environmental impacts. The project complies with all environmental regulations of Thailand. Also the DNA of Thailand through its approval letter has confirmed that the project contributes to sustainable development of the country.

In summary, it is SIRIM QAS Intl.'s opinion that the "Natural gas based cogeneration plant at IRPC Public Co. Ltd. Thailand" as described in the PDD version 03, dated 02nd November 2012 meets all relevant UNFCCC requirements for the CDM, is eligible as category I under scope I of the large-scale CDM project activities and correctly applies the baseline and monitoring methodology specified in AM0048 (version 03). As such, SIRIM QAS Intl. recommends the registration of the project as a CDM project activity.

Prepared by :



Ms. Aernida Abdul Kadir
(Validation Team Leader)

Approved by :



Parama Iswara Subramaniam
(DOE Representative)

6.0 REFERENCES

6.1 Information Reference List

Ref. No.	Document or Type of Information
/1/	VV Manual Version 01.2 (http://cdm.unfccc.int/Reference/Manuals/index.html)
/2/	PDD version 01
/2.1/	Revised PDD version 01.1, 24/06/2011
/3/	Revised PDD version 02, dated 06/01/2012
/4/	Revised PDD version 02.1, dated 10/02/2012
/4.1/	Revised PDD version 03, dated 02/11/2012
/5/	LoA from TGO dated 09 th December 2010 (Ref No. TGO No.02/777)
/6/	Modalities of Communication
/6.1/	Electricity Supply Agreement
/7/	Commercial Operation Date of Unit 3: on 21 st January 2011
/8/	Supply agreement for six units of FR6B turbine generator unit - PG6581B with Nuovo Pignone S.p.A
/9/	Annual Report of 2007
/10/	AM0048, version 3
/10.1/	Steam Purchase Agreement with IRPC
/10.2/	Remaining Life Assessment Report
/10.3/	Tool to determine the remaining lifetime of equipment
/11/	Tool for the demonstration and assessment of additionality
/12/	IRPC Corporate Planning Guidance
/13/	Benchmarks calculations excel sheet
/14/	Detailed technical and financial investigation by internal set up committee
/15/	Estimate based on quotes for GE turbines and consultancy with EGAT - Proposal dated. 12/03/2007
/16/	Standard assumption based on total corporate loan in 2007
/17/	GE turbine specifications
/18/	Existing cogen plant operation details
/19/	Project IRR calculations excel sheet
/19.1/	Operation and Maintenance Strategies to Enhance Plant Profitability
/19.2/	Gas sale invoice of PTT before investment decision
/19.3/	Electricity sale bill to EGAT before investment decision
/19.4/	Actual electricity sale bill to customers after project implementation
/19.5/	Actual steam sale bill to customers at investment decision
/19.6/	Estimate as per the proposal for approval of project investment to Board, pg. 6
/20/	Internal committee proposes gas based cogen project – 09 th February 2007
/21/	Internal memo for preparation of feasibility report) – 20 th February 2007
/22/	Proposal to provide technical advisor services for the project activity by 'The Development Group, Electricity Generating Authority of Thailand' – a Government agency – 12 th March 2007
/23/	Feasibility report
/24/	LOI with GE required for CDM registration process – dated: 25 th May 2007
/25/	IRPC Board of Directors meeting for implementation of project -dated: 19 th June 2007
/26/	GTs arrived at the IRPC site - 20 th October 2008
/27/	EIA approval from Ministry of Natural Resources - 3 rd March 2009
/28/	Agreement for supply of Natural Gas– 09 th June 2009

/29/	Appointment of the CDM consultants -09 th October 2009
/30/	Local Stakeholders consultation meeting -12 th January 2010
/31/	Appointment of present DOE –05 th July 2010
/32/	Tool to determine the baseline efficiency of thermal or electric energy generation systems, V. 01, EB 48, Annex 12
/33/	Tool to calculate the emission factor for an electricity system Version 2.0 (EB 50)
/34/	Tool to calculate the emission factor for an electricity system Version 2.2.1 (EB 63, annex 19)
/35/	CER calculation excel sheet
/36/	EIA report by Air Save Co. Ltd - July 2007
/37/	Local Stakeholders invitation
/38/	Local Stakeholders attendance list
/39/	Minutes of the stakeholder meeting

APPENDIX A
VALIDATION PROTOCOL
Project No. SQAS-CDM-ES12880049

Table 1 Mandatory Requirement for Large Scale Clean Development Mechanism (CDM) Project Activities

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference / Comment
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3	Kyoto Protocol Art.12.2	OK	The Project will reduce GHG emissions. However in Section A.3 no Annex I party has been identified by the PP and this is a unilateral project.
2. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof	Kyoto Protocol Art. 12.2, Marrakesh Accords, CDM Modalities §40a	OK	Section A.3 of the PDD indicated that Thailand (non-annex I party) is the host country and Section A.2 of the PDD justifies the compliance to National SD requirements. The confirmation of the host country has also been obtained (Ref No. TGO No.02/777 dated 09 th December 2010).
3. The project shall have the written approval of voluntary participation from the designated national authorities of each party involved	Kyoto Protocol Art. 12.5a, Marrakesh Accords, CDM Modalities §40a	OK	Letter of approval indicating voluntary participation from designated national authority of Thailand, TGO has been issued on 09 th December 2010.
4. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change	Kyoto Protocol Art. 12.5b	OK	The continuous monitoring of the parameters in the monitoring plan in Section B.7 of the PDD will result in the project contributing to emission reductions which are

* MoV = Means of Verification, DR= Document Review, I= Interview

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference / Comment
			real, measurable and give long-term benefits related to the mitigation of climate change.
5. Reduction in GHG emissions shall be additional to any that would occur in absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity	Kyoto Protocol Art. 12.5c, Marrakesh Accords, CDM Modalities §43	Depends on closure of CAR 6, CAR 7 and CL 3. OK	The present project activity is additional, as the anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.
6. Potential public funding for the project from Parties in Annex I shall not be a diversion of official development assistance	Marrakech Accords	OK	There is no public funding from Annex I Parties or ODA involved in the project financing. The project is being financed through equity and debt as mentioned in Section A.4.5 of PDD.
7. Parties participating in the CDM shall designate a national authority for the CDM	Marrakech Accords, CDM Modalities §29	OK	Thailand Greenhouse Gas Management Organization (TGO) is the Thailand DNA.
8. The host country shall be a Party to the Kyoto Protocol	Marrakech Accords, CDM Modalities §30	OK	The host country, Thailand ratified the Kyoto Protocol on 28 th August 2002.
9. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received	Marrakech Accords, CDM Modalities §37b	OK	The comments by the local stakeholders are invited and the summary of comment is

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference / Comment
			provided in the Section E.2 of the PDD. This has been confirmed by interview conducted with local stakeholders during the on-site audit.
10. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out.	Marrakech Accords, CDM Modalities §37c	Depends on closure of CL 12. OK	As per the requirements, a detailed EIA study is completed by Air Save Co. Ltd. in July 2007. The detail report for the same was reviewed. The significant environmental impacts of the project activity along with the measures taken to mitigate the impacts and the conclusions are enumerated in Appendix A of PDD. The mitigation measures that have been adopted for the project are also elaborated in section D of PDD.
11. Baseline and monitoring methodology shall be previously approved by the CDM Methodology Panel	Marrakech Accords, CDM Modalities §37e	OK	The baseline methodology AM0048 version 03 is approved by the EB 52 and is the active.
12. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP.	Marrakech Accords, CDM Modalities §37f	Depends on closure of CL 7, CL 8, CL 9, CL 10 and CL 11.	Provisions for monitoring, verification and reporting GHG emission data as per the requirement of monitoring

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference / Comment
		OK	methodology of AM0048 is described in Section B.7.2 of the PDD and is in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP.
13. Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available.	Marrakech Accords, CDM Modalities, §40	OK	<p>The PDD version 01 dated 15th February 2010 was made available for Parties, Stakeholders and UNFCCC accredited NGOs to comment via UNFCCC website (http://cdm.unfccc.int/Projects/Validation/DB/YSN6WMVN6FCHIXZ2AE08PRM1WC45T1/view.html) from 09th October 2010 to 07th November 2010 for a period of 30 days.</p> <p>No comments were received during this period.</p>
14. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances.	Marrakech Accords, CDM Modalities, §45c,d	OK	Baseline has been established based on the Baseline Methodology of AM0048 on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances.
15. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or	Marrakech Accords, CDM	OK	The approved applied methodology ensures that no

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REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference / Comment
due to force majeure	Modalities, §47		CERs are earned due to decrease in activity level outside the project activity or due to force majeure.
16. The project design document shall be in conformance with the UNFCCC CDM-PDD format	Marrakech Accords, CDM Modalities, Appendix B, EB Decisions	OK	Latest active CDM-PDD format Version 03 - in effect as of: 28 July 2006 has been used.

Table 2 Requirements Checklist

CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
A. General Description of Project Activity <i>The project design is assessed.</i>				
A.1. Project Boundaries <i>Project Boundaries are the limits and borders defining the GHG emission reduction project.</i>				
A.1.1. Are the project's spatial (geographical) boundaries clearly defined?	DR, SV	Yes, as mentioned in A.4.1, the project's spatial (geographical) boundaries clearly defined The project activity is located at IRPC Industrial Estate in Rayong, Thailand. The geographic coordinates of the project activity plant are - 101°18'44.56" E and 12°39'26.49" N. Site visit confirms it.	OK	OK
A.1.2. Are the project's system (components and facilities used to mitigate GHGs) boundaries clearly defined?	DR, SV	Yes, the projects system (components and facilities used to mitigate GHGs) boundaries are clearly defined in Section B.3 of the PDD. AS per the applied methodology AM0048, boundary is defined as "The project boundary includes the site of the project facility(s) and the sites of all project customer(s)".	OK	OK
A.1.3. Are the data, input parameters and description of project provided in a consistent manner?	DR	No, i. The gas turbine model mentioned in the		

* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>PDD is not consistent. Please make it consistent and provide documentary evidence for the gas turbine model used in the project activity.</p> <p>ii. Please make the natural gas unit consistent in the PDD, CER and financial calculation sheets.</p> <p>iii. The details of the project customers and monitoring information of the same are not evident from the PDD. Clarify</p>	CL 4	OK
A.2. Technology to be employed <i>Validation of project technology focuses on the project engineering, choice of technology and competence/maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.</i>				
A.2.1. Does the project design engineering reflect current good practices?	DR, SV	Yes, the project design engineering reflects current good practices.	OK	OK
A.2.2. Does the project use state of the art technology or would the technology result in a significantly better performance than any commonly used technologies in the host country?	DR, SV	The project uses state of the art technology (Combined Cycle Power plant) which will result in a significantly better performance than any commonly used technologies in the host country as evidenced from the technical specifications described in section A.4.3 of the PDD.	OK	OK

* MoV = Means of Verification, DR= Document Review, I= Interview

SIRIM QAS INTERNATIONAL SDN BHD

CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
A.2.3. Is the project technology likely to be substituted by other or more efficient technologies within the project period?	DR, SV	<p>Project activity has opted to implement latest technology with high efficiency, Hence it is unlikely to be substituted by other more efficient technologies within the crediting period.</p> <p>However, the technical/operational lifetime of the equipments mentioned in Section A.4.2 has not been substantiated with relevant evidences.</p>	CAR-1	OK
A.2.4. Does the project require extensive initial training and maintenance efforts in order to work as presumed during the project period?	DR, SV	<p>The project requires very high degree of skill and experienced personnel for Operation & Maintenance in order to work as presumed during the project period.</p> <p>However, the Operation and maintenance (O & M) agreement documents have not been submitted to the DOE.</p>	CAR-2	OK
A.2.5. Does the project make provisions for meeting training and maintenance needs?	DR, SV	<p>No, It is not evident that PP has made provisions for meeting training and maintenance needs. Clarify</p> <p>Also refer CAR 2.</p>	CL-2	OK
A.2.6. Is the PDD prepared in accordance with the latest template and guidance from the CDM Executive	DR	Yes, the PDD format used is Version 03 in effect as of: 28 July 2006 which is in		

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SIRIM QAS INTERNATIONAL SDN BHD

CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
Board available on the UNFCCC CDM website.		<p>conformance with the UNFCCC CDM-PDD format.</p> <p>However, the following sections of the PDD are not according to CDM-PDD guidelines.</p> <ul style="list-style-type: none"> • Table in Section A.4.4 and • The font and font size in page no.29 and • Table in Section B.6.4 	CAR-3	OK
A.2.7. Does the PDD indicate/demonstrate awareness of CDM prior to the project activity start date? And that benefit from CDM was decisive factor in the decision to proceed with the project?	DR	No, Documentary evidence for prior consideration / awareness of CDM before date of board decision is yet to be submitted by the PP.	CAR-4	OK
A.3. Contribution to Sustainable Development <i>The project's contribution to sustainable development is assessed.</i>				
A.3.1. Is the project in line with relevant legislation and plans in the host country?	DR	No, NoC for setting up the project like (i.e., Consent to establish/operate) has not been provided to the DOE.	CAR-5	OK
A.3.2. Is the project in line with host-country specific CDM requirements?	DR	Yes, the project is in line with host-country specific CDM requirements. Thailand Greenhouse Gas Management Organization (TGO) is the DNA for Thailand and has indicated four criteria as the sustainable development indicators for the CDM project activities and got LoA from host country on	OK	OK

* MoV = Means of Verification, DR= Document Review, I= Interview

SIRIM QAS INTERNATIONAL SDN BHD

CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		09 th December 2010 (Ref No. TGO No.02/777).		
A.3.3. Is the project in line with sustainable development policies of the host country?	DR	Yes, the project is in line with sustainable development policies of the host country The project has got approval by host country (Ref No. TGO No.02/777 dated 09 th December 2010) confirms the same.	OK	OK
A.3.4. Will the project create other environmental or social benefits than GHG emission reductions?	DR	Yes, the project creates benefits other than GHG emission reduction, the project has direct and indirect social, development and/or technology transfer, economic natural resources and environment benefits which have been mentioned in section A.2 of PDD.	OK	OK
B. Project Baseline <i>The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.</i>				
B.1. Baseline Methodology <i>It is assessed whether the project applies an appropriate baseline methodology.</i>				
B.1.1. Is the baseline methodology previously approved by the CDM Methodology Panel?	DR	Yes, the baseline methodology AM0048 version 03 is approved by the EB 52 and is the active version. Update the PDD with the latest and active version of the tool available on the UNFCCC website.	CAR-12	OK

* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
B.1.2. Is the baseline methodology the one deemed most applicable for this project and is the appropriateness justified?	DR	Yes, the baseline methodology applied for the project has demonstrated in section B.2 of PDD that it is applicable for this project and appropriate.	OK	OK
B.1.3. Are the data, input parameters, correct equations/formulae, description as provided in the PDD in accordance with the methodology selected?	DR	Yes, all the data, input parameters, equations/formulae and their description provided in the PDD are correct and in accordance with the methodology selected	OK	OK
B.1.4. Are all the applicability conditions of the selected methodology justified/addressed correctly in the PDD?		<p>Yes, all the applicability conditions of the selected methodology i.e., AM0048, are justified correctly in the PDD.</p> <p>However, for applicability condition no.5, it is mentioned as "The equipment displaced by the project activity will not be sold or used for other purposes. These are either scrapped or retained as stand by units".</p> <p>If used as stand by unit then, monitor and capture under project activity and leakage.</p>	FAR 1	

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
B.2. Baseline Determination <i>The choice of baseline will be validated with focus on whether the baseline is a likely scenario, whether the project itself is not a likely baseline scenario, and whether the baseline is complete and transparent.</i>				
B.2.1. Is the application of the methodology and the discussion and determination of the chosen baseline transparent?	DR	<p>Yes, the application of the methodology and the discussion and determination of the chosen baseline is transparent. However;</p> <p>The PP has not performed a sensitivity analysis as per CDM Investment guidance [EB 39, 41 & 51]. A sensitivity analysis has to be performed on all factors having a bearing of 20% or more on the capital cost / revenues.</p> <hr/> <p>Please clarify;</p> <p><u>ISSUES RELATED TO FINANCIAL ANALYSIS:</u></p> <ul style="list-style-type: none"> ➤ The selection of approach followed by the PP for the financial analysis needs to be justified. ➤ The financial indicator chosen for the analysis to be justified in line with the latest investment guidance as issued by CDM EB. <p>1. BOARD RESOLUTION:</p>	<p>CAR-6</p> <p>CL-3</p>	<p>OK</p> <p>OK</p>

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>Please furnish certified copy of the Board resolution to vouch the exact date of investment decision.</p> <p>2. COST:</p> <p>It is observed that the cost of the project is mentioned \$212 mu. The PP may provide suitable evidences in the form of offer letters or the like and the Power purchase agreement to substantiate the project cost and electricity tariff.</p> <p>3. It is observed that operating hours has been mentioned 8000 hours. PI. provide authentic credible evidence for verification.</p> <p>4. It is observed that the selling price @ 2.79 Bhat / unit has been considered. PI. provide authentic evidence.</p> <p>5. It is observed that the selling price per unit for Power to EGAT (SPP non-Firm) has been applied @ 2.29 Bhat. PI. provide authentic credible evidence for verification.</p> <p>6. DEBT: EQUITY RATIO:</p> <p>The PP is requested to demonstrate how the debt equity ratio adopted is in line with EB guidance 51 para no. 11. i.e., <i>The cost of other debt recently acquired by the project developer and by applying a debt-equity ratio used by the project developer for investments</i></p>		

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p><i>taken in the previous three years.</i></p> <p>7. RATE OF INTEREST: Please demonstrate how the rate of interest assumed is in line with EB guidance 51 para no. 11 - according to the prevailing commercial interest rates in the region.</p> <p>8. It is observed that the long term loan repayment period has been considered 7 years. PI. provide authentic evidence for verification.</p> <p>9. It is observed that the interest on the long term loan has been calculated on the opening balance amount, it should be calculated quarter wise on the balance amount outstanding. PI. check and correct.</p> <p>10. The assumed prices adopted for natural gas prices have to be correlated to public information. The YOY rise if any assumed is also to be evidenced by authentic evidences.</p> <p>11. It is observed that Furnace Oil reduction per day is stated as 658 MT. PI. provide authentic evidence for verification.</p> <p>12. It is observed that the first year utilization factor @ 25% has been assumed. PI. provide authentic evidence for verification.</p>		

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>13. Interest on working capital has not been considered for calculating NP. Pl. check and correct.</p> <p>14. It is observed that the working capital margin has not been considered as inflow during the final year along with the salvage value for calculating IRR.</p> <p>15. Kindly demonstrate how the approach for assessing additionality is in tune with version 5.2 of EB 39 Report Annex 10.</p> <p>16. HEAT RATE:</p> <p>It is observed that the heat rate is 2728 MBTU/ Hr for natural gas. Kindly provide authentic evidence for verification.</p> <p>17. Please provide detailed sensitivity analysis. PP is also required to demonstrate/explain how the sensitivity analysis provided meets the requirement of paragraph 17 of the EB's latest investment guidance. This is not seen worked out.</p> <p>18. Salvage value has not been considered for calculating the IRR at the end of life span of the project.</p> <p>19. Benchmark file has not been verified since it has not been sent to us.</p>		

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl																																				
		<p>20. Pl. explain the suitability of the benchmark and IRR calculations with reference to "Guidelines on the assessment of investment analysis" version 03, EB 51 Annex 58 (specifically with Guidance 5 & 11) with supporting documents.</p> <p>21. Suitability of the selected benchmark i.e., PIRR for the project activity needs to be justified.</p> <p>22. URLs / OTHER AUTHENTIC EVIDENCES MAY BE PROVIDED FOR THE FOLLOWING:</p> <table><tr><th>Item</th><th>Cell Address</th><th>Value</th></tr><tr><td>Operating Hours</td><td>E 7</td><td>8000 'Hrs/Y in norm. op. yr</td></tr><tr><td>Debt : Equity</td><td>E8</td><td>80:20</td></tr><tr><td>Total Investment</td><td>E9</td><td>212 M\$</td></tr><tr><td>Term Loan interest</td><td>J5</td><td>6%</td></tr><tr><td>Debt repayment</td><td>J6</td><td>7 years</td></tr><tr><td>Depreciation</td><td>J7</td><td>20% SLM</td></tr><tr><td>Exchange rate</td><td>J8</td><td>36 B/U\$</td></tr><tr><td>Income tax</td><td>L4</td><td>15%</td></tr><tr><td>Insurance charges</td><td>N4</td><td>0.30%</td></tr><tr><td>Maintenance</td><td>N5</td><td>2.50%</td></tr><tr><td>PEA Import Replacement</td><td>K13</td><td>2.79</td></tr></table>	Item	Cell Address	Value	Operating Hours	E 7	8000 'Hrs/Y in norm. op. yr	Debt : Equity	E8	80:20	Total Investment	E9	212 M\$	Term Loan interest	J5	6%	Debt repayment	J6	7 years	Depreciation	J7	20% SLM	Exchange rate	J8	36 B/U\$	Income tax	L4	15%	Insurance charges	N4	0.30%	Maintenance	N5	2.50%	PEA Import Replacement	K13	2.79		
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CHECKLIST QUESTION	MoV*	COMMENTS			Draft Concl	Final Concl
		Power to EGAT (SPP Non-Firm)	K14	2.29		
		Power to Customer (Additional)	K15	2.79		
		Power to Own Use (Additional)	K16	2.79		
		Steam to Customer (Additional)	K17	690		
		Steam to Own Use (Additional)	K18	690		
		Escalation	E13	1.2%		
		Natural Gas Price	K21	239		
		Escalation	E21	2%		
		Water & Other Variable Costs	E23	2.20\$ / ton		
		Natural Gas	E37	2728 MBTU/Hr		
		Water & Other Variable Costs	E39	420 T/H of steam		
		Reduction of Furnace Oil	F44	658 MT/day		
		Furnace Oil Price	K42	314		
		HSFO MOPS	F43	-7.5 \$/MT		
		Natural Gas Demand charges	E82	1.75%		
		Labor Cost	K85	=0.8*20/36		
		Labour cost escalation	E85	6%		
		Overhead Expense	E86	90% of labour cost		

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CHECKLIST QUESTION	MoV*	COMMENTS			Draft Concl	Final Concl																			
		<table><tr><td>Admin.</td><td>K87</td><td>=10/36</td></tr><tr><td>Admin. Expenses escalation</td><td>E87</td><td>3%</td></tr><tr><td>Maintenance escalation</td><td>E88</td><td>5%</td></tr><tr><td>Insurance escalation</td><td>E89</td><td>3%</td></tr><tr><td>Legal Reserve</td><td>C121</td><td>5%</td></tr><tr><td>Dividend payment</td><td>C122</td><td>40%</td></tr></table>	Admin.	K87	=10/36	Admin. Expenses escalation	E87	3%	Maintenance escalation	E88	5%	Insurance escalation	E89	3%	Legal Reserve	C121	5%	Dividend payment	C122	40%					
Admin.	K87	=10/36																							
Admin. Expenses escalation	E87	3%																							
Maintenance escalation	E88	5%																							
Insurance escalation	E89	3%																							
Legal Reserve	C121	5%																							
Dividend payment	C122	40%																							
		Kindly provide authentic evidences for the parameters in the above table.																							
		23. Submit the revised financial excel sheet as per the latest and active version of the “Guidelines on the assessment of investment analysis” available on the UNFCCC website.																							
		<hr/> Please clarify;																							
		a) In section B.4 of PDD, most plausible alternatives of baseline scenario has been analysed as per the methodology and the available alternatives have been listed out as under.																							
		1. Project activity (new natural gas based cogen unit) taken without CDM																							
		2. Continuation of existing scenario – onsite FO based steam generation and for electricity mix of onsite generation and grid purchase																							
					CL-14	OK																			

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>3. Project customer could have switched to higher GHG intensive fuel – coal</p> <p>However, PP has not indicated /identified the economically most attractive baseline scenario alternative in quantitative terms.</p> <p>Without a comparative financial index how PP is concluding that alternatives 1 and 3 will not be attractive compared to option 2. Further PP's attention is drawn to the following clause step 2 Investment analysis of methodology AM0048 version 3 EB 52 reproduced below.</p> <p><i>If using investment analysis, internal rate of return (IRR) of all the alternatives shall be estimated and compared to assess additionality. If the IRR of the implementing project activity without CDM is less than the other alternatives and less than accepted benchmark for rate of return within the country, then the implementation of project facility is additional</i></p> <p>PP shall justify considering the above stipulations in the methodology.</p> <p>If fuel switch option is not available, Why the following plausible alternative (Alternative 3) is mentioned.</p> <p>“Project customer could have switched to</p>		

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>higher GHG intensive fuel – coal”</p> <p>b) Further, reference is made to section II of the methodology which stipulates that ‘The identification of all reasonable potential alternative scenarios shall be made through interviews and/or surveys with each project customer to assess the project customer’s future energy planning (plans for switching to a less carbon-intensive fuel, plans to increase the efficiency of on-site generation, plans that influence energy demand, self-generation capacity, etc.). The objective of the interviews/surveys is to assess for each project customer the potential for changes in the type of fuel used on-site, energy efficiency, on-site generation capacity and demand levels.’</p> <p>The above compliance is not evidenced from the PDD.</p> <p>c) In section B.4 step2 item 4- barrier analysis in PDD it is mentioned that ‘the IRPC’s industrial complex is not undergoing any change (including that in the production capacity) Thus, the energy consumption in baseline and project scenarios is the same’. However from heat/mass balance diagram in section A.4.3 following figures are seen</p>		

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CHECKLIST QUESTION	MoV*	COMMENTS		Draft Concl	Final Concl						
		<table><tr><th>Baseline</th><th>Project activity</th></tr><tr><td>Power-100 MW</td><td>Power- 189 MW</td></tr><tr><td>Steam-450T/hr</td><td>Steam-340.415 T/hr</td></tr></table>	Baseline	Project activity	Power-100 MW	Power- 189 MW	Steam-450T/hr	Steam-340.415 T/hr			
Baseline	Project activity										
Power-100 MW	Power- 189 MW										
Steam-450T/hr	Steam-340.415 T/hr										
		PP shall clarify on the above observations.									
		In the above case of emission on account of steam production, CER Calculation is not capped (in contrast to PP's reply) at three year historic energy use as seen from the calculations. It is capped at 9,150 TJ which is steam purchased by the project customer i from the proposed project facility j in year y (tonnes) is assumed equivalent to steam generation capacity of the project activity i.e. 408.5 TPH or 3,267,984 ton/ year. However in the case of ELBL,j,i,y, CER is capped at three year historic energy. PP shall comment/clarify on this.									
B.2.2.Has the baseline been determined using conservative assumptions where possible?	DR	Yes, the baseline has been determined using conservative assumptions.		CL-4	OK						
		However, please provide details of <ul style="list-style-type: none">Number of operating hours of baseline steam boilers andQuantity of oil (FO, propane, diesel and butane) consumed by the individual boilers during its operation.									

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
B.2.3.Has the baseline been established on a project-specific basis?	DR	Yes, the baseline has been established on a project-specific basis.	OK	OK
B.2.4.Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	DR	Yes, the baseline scenario of AM0048 which has been applied to the project activity sufficiently takes into account relevant national and/or sectoral policies, macro-economic trends and political aspirations of the host country.	OK	OK
B.2.5.Is the baseline determination compatible with the available data?	DR	<p>Yes, the baseline determination is compatible with the available data.</p> <p>However, please clarify,</p> <p>In pre-project scenario, it is mentioned that “the steam demand was being met by in-house coal and oil (FO, propane, diesel and butane) fired boilers and about 100 MW electricity import from the grid. Two coal based cogen units also exist in the plant and will continue their operations unaffected by the implementation of the CDM project activity. For the same reason, this is not included in the project boundary”.</p> <p>Also refer CL 3</p>	CL-5	OK
B.2.6.Does the selected baseline represent the most likely scenario among other possible and/or	DR	Yes, the selected baseline represents the	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
discussed scenarios?		most likely scenario among other possible and/or discussed scenarios.		
B.2.7. Is it demonstrated/justified that the project activity itself is not a likely baseline scenario (e.g. through (a) a flow-chart or series of questions that lead to a narrowing of potential baseline options, (b) a qualitative or quantitative assessment of different potential options and an indication of why the non-project option is more likely, (c) a qualitative or quantitative assessment of one or more barriers facing the proposed project activity or (d) an indication that the project type is not common practice in the proposed area of implementation, and not required by a Party's legislation/regulations)?	DR	<p>No,</p> <p>Are similar and operational projects, other than CDM project activities, already "widely observed and commonly carried out" in the defined region. Accordingly, justify and demonstrate about the accessible and non-accessible data/information.</p> <p>Web links provided in the PDD are not reproducible / References for data used in common practice analysis is not provided.</p>	CAR-7	OK
B.2.8. Have the major risks to the baseline been identified?	DR	The major risks to components of the baseline, like $CEF_{j,k}$, $EF_{CO2,ups}$, LNG, $EL_{PF,GR,j,y}$, and $EL_{PJ,j,i,y}$, have been identified. Accordingly, the overall risk of baseline has been identified.	OK	OK
B.2.9. Is all literature and sources clearly referenced?	DR	<p>No, PP should provide</p> <ol style="list-style-type: none"> 1. Evidence/documents to support the total project investment details. 2. Gas supply agreement with PTT Public Company Limited for 64,000 MMBTU/day natural gas. 3. Chronology of events documents 4. EIA report and 	CAR-8	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>5. Documents of stakeholders meeting held on 30/11/2007.</p> <hr/> <p>Provide documentary evidence affirm the</p> <ol style="list-style-type: none"> 1. Efficiency of the baseline boilers and the project activity boilers with clear demarcation of its unique identity. 2. The steam generation data of all the baseline boilers. 3. Residual life time of all the baseline boilers with clear demarcation of its unique identity and 4. For operational and maintenance (including insurance) per annum shown as 2.8% of the capital cost. 	CAR-9	OK
<p>C. Duration of the Project/ Crediting Period <i>It is assessed whether the temporary boundaries of the project are clearly defined.</i></p>				
C.1.1.Are the project's starting date and operational lifetime clearly defined and reasonable?	DR	<p>The date for the supply agreement for main energy units (gas turbines) on 12/10/2007 is indicated as the project start date. The time period given is reasonable as it corresponds to the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity</p> <p>The operational lifetime is not mentioned in</p>	Depend s-on	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		the PDD. Refer CAR 1.	closure of CAR 4	
C.1.2. Is the assumed crediting time clearly defined and reasonable (renewable crediting period of max. two x 7 years or fixed crediting period of max. 10 years)?	DR	No, The Starting date of crediting period mentioned in section C.2.2 of the PDD is not realistic.	CAR 10	OK
D. Monitoring Plan <i>The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed ((Blue text contains requirements to be assessed for optional review of monitoring methodology prior to submission and approval by CDM EB).</i>				
D.1. Monitoring Methodology <i>It is assessed whether the project applies an appropriate baseline methodology.</i>				
D.1.1. Is the monitoring methodology previously approved by the CDM Methodology Panel?	DR	Yes, the applied monitoring methodology AM0048 version 03 is approved by EB 52.	OK	OK
D.1.2. Is the monitoring methodology applicable for this project and is the appropriateness justified?	DR	Yes, the monitoring methodology applied for the project has demonstrated in section B.2 of PDD that it is applicable for this project.	OK	OK
D.1.3. Does the monitoring methodology reflect good monitoring and reporting practices?	DR	Yes, the monitoring methodology reflects good monitoring and reporting practices.	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
D.1.4. Is the discussion and selection of the monitoring methodology transparent?	DR	The discussion and selection of the monitoring methodology and its transparency.	OK	OK
D.2. Monitoring of Project Emissions <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>				
D.2.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	DR, SV, I	Yes the monitoring plan is implemented to collect and archive all data indicated in the methodology to facilitate the estimation & measuring the GHG within the project boundary for the entire crediting period.	OK	OK
D.2.2. Are the choices of project GHG indicators reasonable?	DR, SV, I	Yes, the choices of project GHG indicators are reasonable and are as per the applied methodology.	OK	OK
D.2.3. Will it be possible to monitor / measure the specified project GHG indicators?	DR, SV, I	Yes, it is possible to monitor / measure the specified project GHG indicators.	OK	OK
D.2.4. Will the indicators give opportunity for real measurements of achieved emission reductions?	DR, SV,	Yes, the indicators give opportunity for real measurements and achieving of emission reductions.	OK	OK
D.2.5. Will the indicators enable comparison of project data and performance over time?	DR, SV	Yes the archived GHG emission data will facilitate the evaluation, comparison & performance of project over a period of time.	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
D.3. Monitoring of Leakage <i>It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.</i>				
D.3.1.Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining leakage?	DR, SV	Yes, the monitoring plan provides for the collection and archiving of all relevant data necessary for determining leakage	OK	OK
D.3.2.Have relevant indicators for GHG leakage been included?	DR, SV	<p>Yes all the relevant indicators for GHG leakage have been included in the PDD.</p> <p>However, Document in the PDD the procedures adopted for determining the remaining lifetime of the baseline equipment as per the 'Tool to determine the remaining lifetime of equipment' EB 50, annex 15.</p>	CAR-11	OK
D.3.3.Will it be possible to monitor the specified GHG leakage indicators?	DR, SV	Yes, it will be possible to monitor all the specified GHG leakage indicators.	OK	OK
D.4. Monitoring of Baseline Emissions <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>				
D.4.1.Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?	DR, SV, I	Yes, the monitoring plan in Section B.7 of the PDD comprehensively provides for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period. The on-site visit confirmed the same.	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
D.4.2. Is the choice of baseline indicators, in particular for baseline emissions, reasonable?	DR, SV, I	Yes, the baseline Indicator "Emission factor of the most likely baseline scenario is reasonable and conservative as the lowest value of emission factor out of all the possibility	OK	OK
D.4.3. Will it be possible to monitor the specified baseline indicators?	DR, SV, I	Yes, it will be possible to monitor the specified baseline indicators from the monitored Data. The monitoring plan details the procedure for monitoring based upon practices adopted on-site and ex-ante monitoring.	OK	OK
D.5. Monitoring of Sustainable Development Indicators/ Environmental Impacts <i>It is checked that choices of indicators are reasonable and complete to monitor sustainable performance over time.</i>				
D.5.1. Does the monitoring plan provide the collection and archiving of relevant data concerning environmental, social and economic impacts?	DR, SV, I	Although the monitoring plan does not provide the collection and archiving of relevant data concerning environmental, social and economic impacts the project is in compliance with host country regulations and practices.	OK	OK
D.5.2. Is the choice of indicators for sustainability development (social, environmental, economic) reasonable?	DR, SV, I	Thailand Greenhouse Gas Management Organization (TGO) is the DNA for Thailand and has indicated four criteria as the sustainable development indicators for CDM project activities (i.e., social, development and/or technology transfer, economic natural resources and environment benefits). As the PDD mentions these indicators, the choice of indicators for sustainability development is	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		reasonable (Source: http://www.tgo.or.th/english/index.php?option=com_content&task=view&id=15&Itemid=52).		
D.5.3.Will it be possible to monitor the specified sustainable development indicators?	DR, SV, I	As per Host country requirement, monitoring of sustainable development indicators is not required and method / procedure for the same is not defined by DNA.	OK	OK
D.5.4.Are the sustainable development indicators in line with stated national priorities in the Host Country?	DR, SV, I	Yes, the sustainable development indicators mentioned in the PDD have been stipulated by the Host country in "Sustainable Development Criteria/Indicator for CDM Projects in Thailand" (Source: http://www.tgo.or.th/english/index.php?option=com_content&task=view&id=15&Itemid=52).	OK	OK
D.6. Project Management Planning <i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>				
D.6.1.Is the authority and responsibility of project management clearly described?	DR, SV, I	Yes the authority and responsibility of project management is clearly defined in section B.7 of the PDD.	OK	OK
D.6.2.Is the authority and responsibility for registration, monitoring, measurement and reporting clearly described?	DR, SV, I	Yes the authority and responsibility for registration, monitoring, measurement and reporting are clearly described in section B.7.2 of the PDD, CDM coordinator is the overall responsible for registration.		

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>However, Please clarify, in Section B 7.1 of the PDD; value of the following not provided</p> <ul style="list-style-type: none"> Capacity of the electricity generating equipment 'n' existing at IRPC previous to the implementation of the project activity Total electricity self-generated by IRPC during year 'y' of the crediting period Quantity of LNG consumed in the year 'y' in the project facilities and Quantity of natural gas consumed per fuel type 'k' in the year 'y' in the project facilities <p>And include accuracy class of all the meters used in the project activity.</p>	CL-6	OK
D.6.3.Are procedures identified for training of monitoring personnel?	DR, SV, I	Refer CL 1	Depend s-on Closur e of CL 4	OK
D.6.4.Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?	DR, SV, I	No, In section B.7.2, of the PDD there is no mention of emergency preparedness plan for cases where emergencies can cause unintended emissions.	CL-7	OK

* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
D.6.5.Are procedures identified for calibration of monitoring equipment?	DR, SV, I	No, Please provide the identified procedures for maintenance of monitoring equipments, calibration of equipments and calibration intervals/frequency.	CL-8	OK
D.6.6.Are procedures identified for maintenance of monitoring equipment and installations?	DR, SV, I	No, As the project is not yet commissioned, include a process flowchart indicating relevant monitoring equipments and items in section B.7.1 of the PDD. Also refer to CL 8	CL-9	OK
D.6.7.Are procedures identified for monitoring, measurements and reporting?	DR, SV, I	No, It is not evident from the PDD that review of the reported results/data will be done before data is submitted for verification, internally or externally (eg. Performance report).	CL-10	OK
D.6.8.Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	DR, SV, I	Refer CL 10	Depend s-on Closur e-of CL 10	OK
D.6.9. Are procedures identified for dealing with possible monitoring data adjustments and uncertainties?	DR, SV, I	Procedures for possible monitoring data adjustments and uncertainties are not clear (i.e., procedure to deal with erroneous measurement, identified corrective actions if	CL-11	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		the erroneous measurement would take place during the operation of the project).		
D.6.10.Are procedures identified for review of reported results/data?	DR, SV, I	Refer CL 10	Depend s-on Closur e-of-CL 10	OK
D.6.11.Are procedures identified for internal audits of GHG project compliance with operational requirements where applicable?	DR, SV, I	Refer CL 10	Depend s-on Closur e-of-CL 10	OK
D.6.12.Are procedures identified for project performance reviews before data is submitted for verification, internally or externally?	DR, SV, I	Refer CL 11	Depend s-on Closur e-of-CL 11	OK
D.6.13.Are procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting?	DR, SV, I	Refer CL 11	Depend s-on Closur e-of-CL 11	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
E. Calculation of GHG Emissions by Source <i>It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.</i>				
E.1. Predicted Project GHG Emissions <i>The validation of predicted project GHG emissions focuses on transparency and completeness of calculations.</i>				
E.1.1. Are all aspects related to direct and indirect GHG emissions captured in the project design?	DR, SV, I	Yes all direct and indirect GHG emissions indicated in the applied methodology are captured in the project design.	OK	OK
E.1.2. Are the GHG calculations documented in a complete and transparent manner?	DR, SV, I	In Section B.6.3 of PDD a complete and transparent documentation of GHG calculation is presented.	OK	OK
E.1.3. Have conservative assumptions been used to calculate project GHG emissions?	DR, SV, I	All GHG indicators are evaluated based on data from reliable & authentic source and calculated as per the Tool and methodology approved by CDM EB which ensures the conservativeness of value arrived.	OK	OK
E.1.4. Are uncertainties in the GHG emissions estimates properly addressed in the documentation?	DR, SV, I	Uncertainties in the GHG emission estimates for project emission, baseline emission and leakage are as per the approved Tool and methodology which is addressed in section B.6.3 of PDD.	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
E.1.5. Have all relevant greenhouse gases and source categories listed in Kyoto Protocol Annex A been evaluated?	DR, I	Yes all relevant GHG mentioned in the applied methodology has been evaluated and included in the project (boundary) and represented in section B.3 of PDD.	OK	OK
E.2. Leakage <i>It is assessed whether there leakage effects, i.e. change of emissions which occurs outside the project boundary and which are measurable and attributable to the project, have been properly assessed.</i>				
E.2.1. Are potential leakage effects beyond the chosen project boundaries properly identified?	DR, SV, I	Leakage associated with the production – and in case of natural gas, the transportation and distribution of the fuel has been accounted as per the applied methodology beyond the chosen project boundary.	OK	OK
E.2.2. Have these leakage effects been properly accounted for in calculations?	DR, SV, I	Yes the leakage effects have been properly accounted for in calculations and exhibited in B.6.3 of PDD.	OK	OK
E.2.3. Does the methodology for calculating leakage comply with existing good practice?	DR, SV, I	Methodology for calculating leakage is followed as per the applied methodology and comply with existing good practices However the closure of CAR 8 will ascertain it.	Depend s-on Closure of CAR &	OK
E.2.4. Are the calculations documented in a complete and transparent manner?	DR, SV, I	Yes the calculation of leakage is documented in a complete and transparent manner in B.6.3 of PDD.	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
E.2.5. Have conservative assumptions been used when calculating leakage?	DR, SV, I	All assumptions made for estimation / calculation of leakage has been justified and in accordance with the applied methodology.	OK	OK
E.2.6. Are uncertainties in the leakage estimates properly addressed?		Refer CAR 8	Depend s-on Closur e-of CAR 8	OK
E.3. Baseline Emissions <i>The validation of predicted baseline GHG emissions focuses on transparency and completeness of calculations.</i>				
E.3.1. Have the most relevant and likely operational characteristics and baseline indicators been chosen as reference for baseline emissions?	DR, SV, I	Yes, the operational characteristic like electricity supplied to grid and lowest Emission Factor for baseline has been established as per the applied methodology.	OK	OK
E.3.2. Are the baseline boundaries clearly defined and do they sufficiently cover sources and sinks for baseline emissions?	DR, SV, I	All sources like (1) Gas Turbine (2) Heat recovery steam generator (3) steam turbine generator (4) Station transformers (5) Auxiliary equipments of Gas Turbine and Generator, meters (gas, electricity) and gas supply pipelines. Has been included in baseline boundary. No sink has been identified.	OK	OK
E.3.3. Are the GHG calculations documented in a complete and transparent manner?	DR, SV, I	Yes, the GHG calculations are documented in a complete and transparent manner in B.6.3 of PDD.	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
E.3.4. Have conservative assumptions been used when calculating baseline emissions?	DR, SV, I	<p>The most conservative value for emission factor out of the 3 Emission factor options i.e. Build margin, Combined margin and Coal has been applied for calculation of baseline.</p> <p>However, the calculation of grid emission factor is not clearly demonstrated in the PDD.</p> <hr/> <p>Please clarify;</p> <p>a) In section B.6.3 of PDD-Baseline emission it is indicated that the project activity will have an installed capacity of 227.832 MW. At planned 8,000 annual operating hours, this will generate $EL_{BL,j,i,y} = 1,822,656$ MWh. However, in the Heat/mass balance diagram in section A.4.3 of PDD it is indicated that out of 6 units one is standby. Hence for emission calculations only 5 nos are to be accounted which works out to 1518880 MWh ($37.972 \times 5 \times 8000$).</p> <p>$S_{PJ,j,i,y}$ i.e. steam purchased by the project customer i from the proposed project facility j in year y (tonnes) is assumed equivalent to steam generation capacity of the project activity i.e. 408.5 TPH or 3,267,984 ton/ year. Here also 408.5 TPH is for 6 units. For 5 units it works out to 340.415 TOH (68.083×5).</p>	<p>CAR-13</p> <p>CL-15</p>	<p>OK</p> <p>OK</p>

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		<p>Further, PP has also confirmed in their response referred in Appendix A that only 5 units are in operation and one unit is always standby.</p> <p>This being the case, PP shall clarify whether to consider baseline emission calculations based on 6 units or 5 units operation. However, this will not have any impact on conservative approach but clarity is required in the estimation done.</p> <p>b) Auxiliary power consumption is not indicated in the calculations.</p> <p>Scheme of using standby GT for auxiliary power consumption may be explained in detail. PP shall justify how conservativeness is achieved if auxiliary power consumption is not considered in CER calculations.</p> <p>In respect of auxiliary power consumption, conservative approach is required in CER calculations also. Hence PP may suitably modify and justify the calculations.</p>		
E.3.5.Are uncertainties in the GHG emission estimates properly addressed in the documentation?	DR, SV, I	Uncertainties in Estimation of GHG Emission related to project emission and baseline emission have been addressed and	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		documented.		
E.3.6. Have the project baseline(s) and the project emissions been determined using the same appropriate methodology and conservative assumptions?	DR, SV, I	Yes baseline and project emission has been determined using the same appropriate methodology and conservative assumptions.	OK	OK
E.4. Emission Reductions Validation of baseline GHG emissions will focus on methodology transparency and completeness in emission estimations.				
E.4.1. Will the project result in fewer GHG emissions than the baseline scenario?	DR, SV	The project uses less carbon intensive fuel and more efficient power plant (than the baseline). Hence project result in fewer GHG emissions than the baseline scenario.	OK	OK
F. Environmental Impacts <i>Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.</i>				
F.1.1. Has an analysis of the environmental impacts of the project activity been sufficiently described?	DR	Rapid EIA has been conducted to assess the environmental impacts; The report of rapid EIA sufficiently describes the Impact.	OK	OK
F.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?	DR	Rapid EIA was conducted in accordance with host country requirement and Environmental clearance for the same is approved.	OK	OK
F.1.3. Will the project create any adverse environmental effects?	DR	No, adverse effect has been anticipated by the EIA findings. The significant environmental impacts of the project activity along with the	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
		measures taken to mitigate the impacts and the conclusions are enumerated in Appendix A of PDD.		
F.1.4. Are transboundary environmental impacts considered in the analysis?	DR	No trans-boundary impacts have been identified due to the project activity, as the only based in Rayong, Thailand.	OK	OK
F.1.5. Have identified environmental impacts been addressed in the project design?	DR	No, The identified environmental impacts of the project activity along with the measures taken to mitigate the impacts and the conclusions are not enumerated in the PDD.	CL 12	OK
F.1.6. Does the project comply with environmental legislation in the host country?	DR	Yes the project complies with the requirements of host country and is approved by the host country.	OK	OK
G. Stakeholder Comments <i>The validator should ensure that a stakeholder comments have been invited and that due account has been taken of any comments received.</i>				
G.1.1. Have relevant stakeholders been consulted?	DR	Yes, relevant stakeholders like the locals residing in the neighbouring villages, local health officer, staff of neighbouring college, officials of state electricity board and pollution control board has been considered.	OK	OK
G.1.2. Have appropriate media been used to invite	DR	Identified stakeholders were intimidated by	OK	OK

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CHECKLIST QUESTION	MoV*	COMMENTS	Draft Concl	Final Concl
comments by local stakeholders?		written invitation 15 days prior to the meeting.		
G.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	DR	Host country does not provide any Guideline for conducting stakeholders meeting.	OK	OK
G.1.4. Is a summary of the stakeholder comments received provided?	DR	<p>A summary of the stakeholder comments received has been provided in section E.2 of PDD.</p> <p>However, please clarify,</p> <p>In section E.2 of the PDD (page no.43) to the query raised by Ms.Phanumas Wuthiananchai, the PP has replied by telling the capacity for the plant to be 220MW.</p>	CL-13	OK
G.1.5. Has due account been taken of any stakeholder comments received?	DR	The clarification provided to the stakeholders for their comments have been described in section E.2 of the PDD. All the comments/queries were satisfactorily responded by the PP and the stakeholder viewed the project as useful with significant contribution to local employment and sustainable development.	OK	OK

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Table 3 Resolution of Corrective Action and Clarification Requests

Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<u>CAR 1</u> The technical/operational lifetime of the equipments mentioned in Section A.4.3 has not been substantiated with relevant evidences.	A.2.3	The technical lifetime of the project activity plant is taken from the publication of Department of Treasury 'How to depreciate property' pg. 99 Refer Attachment 'CAR1' which is sourced from web page http://www.irs.gov/pub/irs-pdf/p946.pdf	The technical/operational lifetime of the equipments mentioned in Section A.4.3 of the PDD is now substantiated with evidence (The publication of Department of Treasury 'How to depreciate property' pg. 99). Hence this CAR is resolved. <u>Conclusion:</u> CAR 1 closed
<u>CAR 2</u> The Operation and maintenance (O & M) agreement documents have not been submitted to the DOE.	A.2.4	As the project is not fully commissioned and thus O & M agreement is not signed. Even later, there is an in-house O&M team and no external contract/ agreement covering entire O & M is planned. There will be only specialized maintenance activities which will be done by external service providers as the need arises.	During on-site audit, only 3 out of the 6 units were commissioned. Hence the justification by PP is acceptable. <u>Conclusion:</u> CAR 2 closed
<u>CAR 3</u> The following sections of the PDD are not according to CDM-PDD guidelines. <ul style="list-style-type: none"> • Table in Section A.4.4 and • The font and font size in page no.29 and • Table in Section B.6.4 	A.2.6	1) The Table A.4.4 is modified in line with CDM-PDD guidelines. 2) The font and font size on pg. 29 is changed to Times New Roman, size 11" 3) The Table B.6.4 is modified in line with CDM-PDD guidelines <i>Please refer PDD version 02.</i>	In the revised PDD, the relevant sections are modified, checked and found correct. Hence this CAR is resolved. <u>Conclusion:</u> CAR 3 closed

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<u>CAR 4</u> Documentary evidence for prior consideration / awareness of CDM before date of board decision is yet to be submitted by the PP.	A.2.7	<p>The feasibility report prepared in April 2007 had considered CDM. Further, in a meeting with the equipment supplier (GE), on 25/05/2007 an LOI for turbines supply was signed and it assigned responsibility of CDM registration. These events have taken place before the CDM consideration in meeting dt. 19/06/2007. These documents are attached with responses and demonstrate the prior consideration and awareness of CDM.</p> <p>Refer Attachment 'CAR 4' which includes the minutes of above discussed meeting and internal committee constitution for this feasibility study.</p>	<p>Documentary evidence for prior consideration / awareness of CDM before date of board decision now submitted by the PP was verified and found correct. Hence this CAR is resolved.</p> <p><u>Conclusion:</u> CAR 4 closed</p>
<u>CAR 5</u> NoC for setting up the project like (i.e., Consent to establish/operate) has not been provided to the DOE.	A.3.1	<p>The 'Factory Business Operation in Industrial Zone Certificate' from the Ministry of Industry is equivalent to the NOC for starting the construction is provided to DOE.</p> <p><i>Refer Attachment 'CAR5'</i></p>	<p>NoC for setting up the project has now been submitted by the PP was verification.</p> <p><u>Conclusion:</u> CAR 5 closed</p>
<u>CAR 6</u> The PP has not performed a sensitivity analysis as per CDM Investment guidance [EB 39, 41 & 51]. A sensitivity analysis has to be performed on all factors having a bearing of 20% or more on the capital cost / revenues.	B.2.1	<p>The PDD has presented investment analysis for all the important parameters namely (1) investment cost (or the total project cost), (2) Price of key products and raw materials namely electricity, fuel oil and natural gas, (3) Project schedule (construction time) and (4) other factors e.g. Exchange Rate, Steam Price and</p>	<p>The PP has now performed a sensitivity analysis as per CDM Investment guidance EB 62, annex 5 and included the same in the revised financial calculation sheets and PDD.</p> <p><u>Conclusion:</u></p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
		Utilization Rate. This has covered all the parameters that can impact project expenditure and revenues by 20%. Thus, the sensitivity is performed as per the Guidance EB 51, Annex 58.	CAR 6 closed
<p><u>CAR 7</u></p> <p>Are similar and operational projects, other than CDM project activities, already “widely observed and commonly carried out” in the defined region. Accordingly, justify and demonstrate about the accessible and non-accessible data/information.</p> <p>Web links provided in the PDD are not reproducible / References for data used in common practice analysis is not provided.</p>	B.2.7	<p>An analysis of the all operating power plants at the time of validation start (web hosting PDD) available from the ‘Power Policy Bureau, Energy Policy and Planning Office (EPPO), Ministry of Energy, Thailand’ is being provided in the revised PDD. The data is taken from the EPPO web site (original excel sheets are being provided with important terms translated in English). It shows that there are no operating power plants of this scale and in similar investment environment (as per the ‘Tool for the demonstration and assessment of additionality’).</p> <p>PP Response 2: All the web links used in the PDD are being submitted as pdf files. Please refer attachment ‘CAR 7’.</p>	<p>The validation team verified EPPO list, cross checked the references provided as PDF documents and concludes that similar activities are not widely observed and commonly carried out, hence not a common practice in the region. Project participant has therefore demonstrated that the project activity is not a common practice.</p> <p>Common practice analysis for Thailand is justified and same has been accepted by the validation team. Hence this CAR is closed.</p> <p><u>Conclusion:</u> CAR 7 Closed</p>
<p><u>CAR 8</u></p> <p>PP should provide</p>	B.2.9	<p>1) An internal committee was constituted for the financial analysis of the project. The committees report was presented to the Board of Directors. A report presented by</p>	<p>Now PP has submitted</p> <ol style="list-style-type: none"> 1. Evidence for to support the project cost and has performed a sensitivity analysis as per EB

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
1. Evidence/Documents to support the total project investment details.		<p>this committee is presented to the DOE. This report shows a project cost of 212 Million USD and the same is used for the investment analysis presented in the PDD. This is also further confirmed by the PP's Annual Report in the investment decision year and shows cost of about 200 Mn USD (This is different value than the refined value in investment committee report as it is excluding IDC and other soft costs, rounded off for generic presentation in the report).</p> <p>PP Response 2: This was based on earlier similar offer evident from a 'proposal to provide technical advisor services for the project activity by The Development Group, Electricity Generating Authority of Thailand' – a Government agency. This is dt. 12/03/2007 and mentions (pg. 10) an estimated project cost of 2 x 4,030 million Baht (which at exchange rate of 36 Baht/USD is 223.89 million USD). This cost is used in the financial analysis now. The actual project cost till date is also being submitted and this is within -10% sensitivity range for which the result is presented in the PDD. <i>Please refer attachment 'CAR 8.1 Proposal for iRPC 2x100 MW Cogen Power Project (p. 10)'.</i></p>	<p>62, annex 5 and included the same in the revised financial calculation sheets and PDD.</p> <ol style="list-style-type: none"> 2. Gas supply agreement. 3. Chronology of events documents. 4. EIA report and 5. Documents of stakeholders meeting held on 12/01/2010. <p>Hence this CAR is closed.</p> <p><u>Conclusion:</u> CAR 8 Closed</p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p>2. Gas supply agreement with PTT Public Company Limited for 64,000 MMBTU/ day natural gas.</p> <p>3. Chronology of events documents.</p> <p>4. EIA report and</p> <p>5. Documents of stakeholders meeting held on 12/01/2010.</p>		<p>2) An agreement with PTT is provided to the DOE for supply of natural gas. Present agreement is for 48,000 million BTU/ day. This quantity will be updated as per the actual consumption of six months in June (please refer clause 2.4 of gas supply contract in Attachment CAR8; file '2.Gas supply contract_Eng').</p> <p>3) All the documents referred in the chronology of events in Section B.5 of the PDD are provided to the DOE (<i>Attachment CAR8; file '3.chronology of CDM & project'</i>).</p> <p>4) EIA report in Thai language was shown to the DOE and an English summary of the report is being provided now. (<i>Attachment CAR8; file '4.CHP_EIA_Eng'</i>)</p> <p>5) The invitations to stakeholders, minutes of the meeting and attendance sheet as well as few photos of the meeting are being submitted to the DOE. (<i>Attachment CAR8; file '5.Local stakeholders meeting'</i>)</p> <p>PP Response 2: The invitation letters, minutes of the local stakeholders' meeting (Thai and English) and attendance sheets are also provided now. The original</p>	

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
		documents were shared with validation during the site visit. <i>Please refer attachment 'CAR 8.5 - Stakeholders meeting'.</i>	
<p><u>CAR 9</u></p> <p>Provide documentary evidence affirm the</p> <ol style="list-style-type: none"> 1. Efficiency of the baseline boilers and the project activity boilers with clear demarcation of its unique identity. 2. The steam generation data of all the baseline boilers. 3. Residual life time of all the baseline boilers with clear demarcation of its unique identity and 	B.2.9	<p>1) The efficiency is used as per 'Tool to determine the baseline efficiency of thermal or electric energy generation systems, V. 01, EB 48, Annex 12 Table 1: Default baseline efficiency for different technologies'. A clear demarcation of the baseline boilers is also presented in PDD, Section A.4.3 pg. 7.</p> <p>2) The steam generation data of all baseline boilers is also presented to the DOE from SAP system (ERP) and SGDB report (daily log sheets). A summary is attached now in excel sheet. (<i>Attachment CAR9</i>)</p> <p>PP Response 2: A detailed three years historic operations data for steam and electricity generation and import from grid is being submitted now. <i>Please refer attachments 'CAR 9.2'</i></p> <p>3) The residual life time of the baseline boilers is presented in terms of life cycle analysis reports by a third party engineering company 'General</p>	<p>Now PP has submitted documentary evidence to affirm the</p> <ol style="list-style-type: none"> 1. Efficiency of the baseline boilers and the project activity boilers with clear demarcation of its unique identity. 2. The steam generation data of all the baseline boilers. 3. Residual life time of all the baseline boilers with clear demarcation of its unique identity and 4. For operational and maintenance (including insurance) per annum shown as 2.8% of the capital cost. <p>Hence this CAR is closed.</p> <p><u>Conclusion:</u> CAR 9 Closed</p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
4. For operational and maintenance (including insurance) per annum shown as 2.8% of the capital cost.		Maintenance Engineering Co. Ltd.' (Attachment CAR9; Folder '3.Residual lifetime analysis reports') 4) The O&M is taken from the experience of existing coal based cogen plant discussions with the technology supplier.	
<u>CAR 10</u> The Starting date of crediting period mentioned in section C.2.2 of the PDD is not realistic.	C.1.2	The starting date of the crediting period in section C.2.2 of the PDD is now revised to 01/09/2011. PP Response 2: The crediting period starting date is now revised to 15/05/2012. Please refer the updated PDD.	In the revised PDD, the starting date of the crediting period in section C.2.2 is now modified to 15/05/2012. Hence this CAR is closed. <u>Conclusion:</u> CAR 10 Closed
<u>CAR 11</u> Document in the PDD the procedures adopted for determining the remaining lifetime of the baseline equipment as per the 'Tool to determine the remaining lifetime of equipment' EB 50, annex 15.	D.3.2	The residual life time of the baseline boilers is presented in terms of life cycle analysis reports by a third party engineering company 'General Maintenance Engineering Co. Ltd.' The reports is now submitted to the DOE. (Attachment CAR9; Folder '3.Residual lifetime analysis reports')	The residual life time of the baseline boilers are now presented in terms of life cycle analysis reports by a third party engineering company 'General Maintenance Engineering Co. Ltd.' <u>Conclusion:</u> CAR 11 Closed
<u>CAR 12</u> Update the PDD with the latest and active version of the tool available on the UNFCCC website.	B.1.1	The PDD is updated to use the latest versions of methodological tools e.g. 1) "Tool for the demonstration and assessment of additionality", Version	The revised PDD has been updated with latest and active version of the tool available on the UNFCCC website. Hence this CAR is closed. <u>Conclusion:</u>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
		06.0.0 2) "Tool to calculate emission factor for an electricity system", Version 02.2.1 3) Guidelines on the demonstration and assessment of prior consideration of the CDM, Version 04	CAR 12 Closed
<u>CAR 13</u> The calculation of grid emission factor is not clearly demonstrated in the PDD.	E.3.4	A step wise calculation of the grid emission factor in line with "Tool to calculate emission factor for an electricity system", Version 02.2.1 is discussed in the Annex 3 of the revised PDD.	The calculations of grid emission factor are clearly demonstrated in the revised PDD. <u>Conclusion:</u> CAR 13 Closed
<u>CL 1</u> i. The gas turbine model mentioned in the PDD is not consistent. Please make it consistent and provide documentary evidence for the gas turbine model used in the project activity. ii. Please make the natural gas unit consistent in the PDD, CER and financial calculation sheets.	A.1.3	i. The gas turbine model No. is PG6581B and this is evident from the Supply Agreements with Nuovo Pignone S.p.a. Italy. This is further substantiated by the GT name plate photo taken during the site visit (<i>Att. CL 1 – GT name plate</i>). This is made consistent in the revised PDD now. ii. When gas quantity is mentioned in PDD, it is as per contracted demand in MMBTU/ day (as available basis as per the contract). In calculations both CER and PDD), the gas quantity is referred in the energy terms (TJ).	The gas turbine model (i.e., PG6581B) in PDD is made consistent with the Nuovo Pignone S.p.a. Italy supply agreement. The gas quantity is mentioned as MMBTU/ day it is as per contracted demand (as available basis as per the contract) in the PDD. For calculations both CER and PDD), the gas quantity is referred in the energy terms (TJ).

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
iii. The details of the project customers and monitoring information of the same are not evident from the PDD. Clarify		iii. The monitoring plan is updated to include the project customers receiving steam and electricity from the CDM project activity plant. Please refer to Section B.7.2 of the revised PDD.	Section B.7.2 of the revised PDD the monitoring plan is updated to include the project customers receiving steam and electricity from the CDM project activity plant. <u>Conclusion:</u> CL 1 Closed
<u>CL 2</u> It is not evident that PP has made provisions for meeting training and maintenance needs. Clarify	A.2.5	The employees were trained as part of the power plant commissioning and hand over. A sample training records are being submitted to the DOE. (Refer folder 'Att. CL 2')	It is now evident from the documents submitted, that PP has made provisions for meeting training and maintenance needs. <u>Conclusion:</u> CL 2 Closed
<u>CL 3</u> Please clarify; <u>ISSUES RELATED TO FINANCIAL ANALYSIS:</u> ➤ The selection of approach followed by the PP for the financial analysis needs to be justified. ➤ The financial indicator chosen for the analysis to be justified in line with the latest investment	B.2.1	The internal rate of return (IRR) on investment as financial indicator is one of the known financial indicator used by banks, financial institutions and project developer for making investment decision. The IRPC Corporate Planning Guidance also recommends use of project IRR as the suitable financial indicator for the evaluation of new investments and also gives annual WACC acceptable for the viability of projects. Thus, project IRR was chosen as the	Justification by the PP for selection of project IRR as the financial indicator and its comparison with WACC as the benchmark is acceptable, hence this query is resolved.

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guidance as issued by CDM EB.		financial indicator and it was compared with WACC.	
1. BOARD RESOLUTION: Please furnish certified copy of the Board resolution to vouch the exact date of investment decision.		1) A copy of Board resolution for the CDM consideration is presented to the DOE.	Certified copy of the Board resolution is now submitted for validation in which the date of investment decision (i.e., 19 th June 2007) for project activity is indicated and need for CDM revenue is mentioned. Hence this query is resolved.
2. COST: It is observed that the cost of the project is mentioned \$212 mu. The PP may provide suitable evidences in the form of offer letters or the like and the Power purchase agreement to substantiate the project cost and electricity tariff.		An internal committee was constituted for the financial analysis that was presented to the Board of Directors. A report presented by this committee is presented to the DOE. Thus shows a project cost of 212 Million USD and the same is used for the investment analysis presented in the PDD. This is also further confirmed by the PP's Annual Report in the investment decision year and shows cost of about 200 Mn USD (This is different value than the refined value in investment committee report as it is excluding IDC and other soft costs, rounded off for generic presentation in the report). PP Response 2: Electricity Generation Authority of Thailand (EGAT - a Govt Company) was involved in the process of costing – refer pg. 10 of proposal from EGAT. The project cost referred there is 2 x 4030 million Baht (which at 36 Baht/ USD	Clarification by the PP to substantiate the project cost and electricity tariff is acceptable, hence this query is resolved.

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		becomes USD 223.89 million). This is used now for the investment analysis and the actual project cost (till date) being submitted now is within -10% sensitivity conducted. <i>Please refer attachment 'CAR 8.1 Proposal for iRPC 2x100 MW Cogen Power Project (p. 10)'</i> .	
<p>3. It is observed that operating hours has been mentioned 8000 hours. Pl. provide authentic credible evidence for verification.</p>		<p>3) The operating hours of project activity plant are decided based on historic operations of boilers in existing cogen plant in 2006. The project activity plant is also expected to be operating at same level based on process demand in petroleum refining plant. (Refer Att. CL3, file 3)</p> <p>PP Response 2: The power plant will have routine annual and major maintenance shut downs. The operating hours used from the historic plant operation are equivalent to 91.32% PLF [8,000/ (24 x 365)] and thus is not likely to increase under any practical scenario given maintenance shut downs etc. Also, one of the 6 units will be always standby. Thus, this capacity utilization estimate is conservative.</p>	<p>Clarification by the PP for considering 8000 operating hours is acceptable, hence this query is resolved, hence this query is resolved.</p>
<p>4. It is observed that the selling price @ 2.79 Baht / unit has been considered. Pl. provide authentic evidence.</p>		<p>4) This is the replacement cost of electricity imported from the grid. Actual invoices before the investment decision for the electricity purchase from grid is being</p>	<p>Actual invoices for replacement cost of electricity imported from the grid before the investment decision is submitted, hence this query is</p>

* MoV = Means of Verification, DR= Document Review, I= Interview

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		submitted	resolved.
5. It is observed that the selling price per unit for Power to EGAT (SPP non-Firm) has been applied @ 2.29 Baht. Pl. provide authentic credible evidence for verification.		5) An indicative power purchase rate from grid for the non-firm SPP was available is being submitted to the DOE	An indicative power purchase rate from grid for the non-firm SPP is now being submitted by PP for validation, hence this query is resolved.
6. DEBT: EQUITY RATIO: The PP is requested to demonstrate how the debt equity ratio adopted is in line with EB guidance 51 para no. 11. ie., <i>The cost of other debt recently acquired by the project developer and by applying a debt-equity ratio used by the project developer for investments taken in the previous three years.</i>		6) The investment committee evaluating this project had considered D/E of 0.8:1. This is also in line with the total corporate debt available in the investment decision year (as evident from the Annual Report submitted to DOE). The Annual report (pg. No. 56) shows debt/equity in 2007 as 0.45. i.e. $(0.8/1.8) = 0.4444$ PP Response 2: Soft copy was shared in site. The report is available online at web link http://irpc.listedcompany.com/misc/ar/AR2007EN.pdf	The clarification by PP for considering D/E of 0.8:1 as it is in line with the total corporate debt available in the investment decision year (as evident from the Annual Report pg. No. 56). Hence query is closed.
7. RATE OF INTEREST: Please demonstrate how the rate of interest assumed is in line with EB guidance 51 para no. 11 - according to the prevailing commercial interest rates in the region.		7) The investment committee evaluating this project had considered the same interest rate and this was also the rate as per the Corporate Planning guidance for WACC calculation (submitted to DOE). PP Response 2: As per the annual report of PP in the investment decision (for year 2007, pg. 55), the average interest rate for long terms loans was 5.29%. The same is	The rate of interest used for the project activity is 5.29%, which is in line with the Guidance 11 of EB 62, Annex 5, hence this query is resolved.

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
		used in line with the Guidance 11 of EB 62, Annex 5.	
<p>8. It is observed that the long term loan repayment period has been considered 7 years. PI. provide authentic evidence for verification.</p>		<p>8) The investment committee evaluating this project had considered repayment over 8 years in line with the recently availed debt/ discussions with lenders.</p> <p>In line with the Guidance 11 of EB 62, Annex 5 – the actual interest rate is used. The supporting loan sanction is being submitted. <i>Please refer attachment 'CL 3.8 - interest rate'.</i></p>	<p>The clarification by PP for considering repayment over 8 years in line with the recently availed debt/ discussions with lenders is acceptable as it is in line with the Guidance 11 of EB 62, Annex 5. Hence query is closed.</p>
<p>9. It is observed that the interest on the long term loan has been calculated on the opening balance amount, it should be calculated quarter wise on the balance amount outstanding. PI. check and correct.</p>		<p>9) The IRPC is paying interest repayment based on annual repayment schedule and hence this is calculated in this same way.</p> <p>In line with the Guidance 11 of EB 62, Annex 5 – the actual interest rate is used. The supporting loan sanction is being submitted. <i>Please refer attachment 'CL 3.8 - interest rate'.</i></p>	<p>As IRPC is paying interest repayment based on annual repayment schedule, this is calculated on the opening balance amount. Which is in line with the Guidance 11 of EB 62, Annex 5. The supporting loan sanction is now being submitted. Hence query is closed.</p>
<p>10. The assumed prices adopted for natural gas prices have to be correlated to public information. The YOY rise if any assumed is also to be evidenced by authentic evidences.</p>		<p>10) A communication with PTT (natural gas supplier) before the investment decision had given price of gas linked with crude oil in Dubai market (\$/BBL) and there is a premium and escalation as per PTT website. (Refer Att. CL3, file 10a and 10b)</p> <p>PP Response 2: Submitted file CL3, File</p>	<p>The assumed prices adopted for natural gas prices has now been provided wide “file 10b” calculated price till 2011 based on Dubai market crude oil price index and pdf file is also submitted from gas supplier PTT.</p>

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		10b has clearly calculated price till 2011 based on Dubai market crude oil price index. This pdf file was also submitted from gas supplier PTT.	
11. It is observed that Furnace Oil reduction per day is stated as 658 MT. Pl. provide authentic evidence for verification.		11) This is used as the savings due to discontinuation of existing pre-project steam boilers. This is one of the products of IRPC refinery and is evident from an energy balance before investment decision (Refer Att. CL3, file 11).	Clarification for assuming furnace oil reduction per day as 658 MT is acceptable. Now "energy balance before investment decision" is submitted as evidence for verification. Hence this query is resolved
12. It is observed that the first year utilization factor @ 25% has been assumed. Pl. provide authentic evidence for verification.		12) As only one unit was going to be operational in the first year as per schedule at the investment decision with subsequent units being operational one by one later. Thus, effectively, in first financial year, the utilization factor was 25%. PP Response 2: The PP had approved project activity in June 2007 and considering about two years construction period, the project was to get commissioned in phase wise manner in the last quarter of 2009. Thus, the project activity will operate only for the last quarter in the first financial year. This results in the 25% utilization factor used in the analysis. <i>Please refer 'CI 3.12 - CHP start up plan used at the investment decision'.</i>	Clarification for assuming 25% utilization factor for the first year in analysis is acceptable. PP has now submitted "CHP start up plan used at the investment decision", hence this query is resolved.
13. Interest on working capital has not been considered for calculating NPV. Pl. check and		13) NPV was deleted from the financial calculation sheet as it is not used in the	In the revised financial calculation sheets now NPV is deleted, hence

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correct.		additionality demonstration. Thus, this CAR has lost significance.	this query is resolved.
14. It is observed that the working capital margin has not been considered as inflow during the final year along with the salvage value for calculating IRR.		14) The working capital margin is added back in final year Cell AD129 along with 10% salvage value. Now the salvage value (10%) of the capital cost is also added back to the as inflow in the final year (Refer CHP model, row 129).	In the revised financial calculation sheet now the salvage value (10%) of the capital cost is also added back to the as inflow in the final year in CHP model, row 129.
15. Kindly demonstrate how the approach for assessing additionality is in tune with version 5.2 of EB 39 Report Annex 10.		15) In line with the Guidance from EB 39, Annex 10, Section B.5 of the PDD has given step wise approach for demonstration of additionality. In the Step 2, Investment analysis, Benchmark Analysis is applied (under step 2b, option III). The analysis is also complete with the sensitivity analysis and finally common practice analysis.	The approach for assessing additionality is now been clearly demonstrated in the revised PDD, hence this query is resolved.
16. HEAT RATE: It is observed that the heat rate is 2728 MBTU/ Hr for natural gas. Kindly provide authentic evidence for verification.		16) The heat rate is used from the communication with the discussions with equipment supplier (Refer Att. CL3, file 16).	Evidence for the heat rate of 2728 MBTU/ Hr for natural gas used in calculation is now provided for verification.
17. Please provide detailed sensitivity analysis. PP is also required to demonstrate/explain how the sensitivity analysis provided meets the requirement of paragraph 17 of the EB's latest investment guidance. This is not seen worked out.		17) The PDD has presented investment analysis for all the important parameters namely (1) investment cost (or the total project cost), (2) Price of key products and raw materials namely electricity, fuel oil and natural gas, (3) Project schedule (construction time) and (4) other factors e.g. Exchange Rate, Steam Price and	The revised financial calculation sheet were verified and found that all applicable parameters are varied by 10% and for heat rate and (electricity and steam) sales price by 5%, hence this query is resolved.

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		<p>Utilization Rate.</p> <p>This has covered all parameters that can impact project expenditure and revenues by 20%. Thus, the sensitivity is performed as per the Guidance EB 51, Annex 58.</p> <p>PP Response 2: The financial analysis is revised now to vary all applicable parameters by 10% and for heat rate and (electricity and steam) sales price by 5%. <i>Please refer revised financial model.</i></p>	
<p>18. Salvage value has not been considered for calculating the IRR at the end of life span of the project.</p>		<p>18) Salvage value (10% of the capital cost) is now added back in the cash inflow in calculating IRR in the last year of operation. (Refer CHP model, row 129).</p>	<p>The revised financial calculation sheet were verified and found salvage value (10% of the capital cost) is now added back in the cash inflow in calculating IRR in the last year of operation the actual, hence this query is resolved.</p>
<p>19. Benchmark file has not been verified since it has not been sent to us.</p>		<p>19) The benchmark used is from the Corporate Planning guidance and is being submitted now. (Refer Att. CL3, file 7 WACC).</p> <p>PP Response 2: The beta values are not provided from a public source in form of computer screen shots. <i>Please refer WACC sheet.</i></p> <p>The D/E ratio is also matching with the investment approval and the actual.</p>	<p>The revised financial calculation sheet were verified and found that the D/E ratio is matching with the investment approval and the actual, hence this query is resolved.</p>

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<p>20. PI. explain the suitability of the benchmark and IRR calculations with reference to "Guidelines on the assessment of investment analysis" version 03, EB 51 Annex 58 (specifically with Guidance 5 & 11) with supporting documents.</p>		<p>20) As per the Guidance, para 5 'Depreciation, and other non-cash items related to the project activity, which have been deducted in estimating gross profits on which tax is calculated, should be added back to net profits for the purpose of calculating the financial indicator (e.g. IRR, NPV). Taxation should only be included as an expense in the IRR/NPV calculation in cases where the benchmark or other comparator is intended for post-tax comparisons.'</p> <p>In the cash flow statement, row no. 104 has added depreciation; row 102 has added change in working capital row 129 has added salvage value. Taxation is also included as the benchmark is also post tax. This has also followed the para 11 of the Guidance.</p> <p>PP Response 2: The post tax IRR is compared with a post tax benchmark.</p>	<p>Clarification given by the PP for choosing post-tax IRR and comparing with a post-tax benchmark is acceptable, hence this query is resolved.</p>
<p>21. Suitability of the selected benchmark i.e., PIRR for the project activity needs to be justified.</p>		<p>21) The IRPC Corporate Planning Guidance also recommends use of project IRR as the suitable financial indicator for the evaluation of new investments and also gives annual WACC acceptable for the viability of projects.</p> <p>Thus, project IRR was chosen as the financial indicator and it was compared</p>	<p>Clarification given by the PP for choosing project IRR as the financial indicator against WACC as benchmark is acceptable, hence this query is resolved.</p>

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					with WACC.	
22. URLs / OTHER AUTHENTIC EVIDENCES						All the URLs / authentic evidences requested are now been submitted by PP for validation, hence this query is closed. Conclusion: CL 3 Closed
	Item	Cell Address	Value			
a	Operating Hours	E 7	8000 'Hrs/Y in norm. op. yr	a	a) Operating hours discussed in CL 3, point 3.	
b	Debt : Equity	E8	80:20	b	b) D/E is discussed in CL 3, point 6.	
c	Total Investment	E9	212 M\$	c	c) Project cost is discussed in CL3, point 2.	
d	Term Loan interest	J5	6%	d	d&e) Interest rate and repayment schedule is discussed in CL 3, point 7 & 8	
e	Debt repayment	J6	7 years	e		
f	Depreciation	J7	20% SLM	f	f) Depreciation is using straight line method over 20 years i.e. 100/20 = 5%.	
g	Exchange rate	J8	36 B/U\$	g	g) Exchange rate is taken from Bank of Thailand (MID RATE @ Avg.Nov&DEC 2006)	
h	Income tax	L4	15%	h	h) income tax rate is taken from Board of Investment of Thailand	
i	Insurance charges	N4	0.30%	i	i) Insurance charge is discussed in CAR 9, point 4	
j	Maintenance	N5	2.50%	j	j) Maintenance charge is discussed in CAR 9, point 4	
k	PEA Import Replacement	K13	2.79	k	k to q) Power to EGAT, customer, owner, as well as the stream to	
l	Power to EGAT (SPP Non-Firm)	K14	2.29			

* MoV = Means of Verification, DR= Document Review, I= Interview

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<i>m</i>	<i>Power to Customer (Additional)</i>	<i>K15</i>	<i>2.79</i>		<i>n</i>		
					<i>o</i>		
<i>n</i>	<i>Power to Own Use (Additional)</i>	<i>K16</i>	<i>2.79</i>		<i>p</i>		
					<i>q</i>		
<i>o</i>	<i>Steam to Customer (Additional)</i>	<i>K17</i>	<i>690</i>		<i>r</i>	r&s) NG price & escalation is discussed in CL 3, point 10.	
					<i>s</i>		
<i>p</i>	<i>Steam to Own Use (Additional)</i>	<i>K18</i>	<i>690</i>		<i>t</i>	t) Water& Other Variable Costs is taken from experience of existing cogen plant (CL 3, file 22t)	
<i>q</i>	<i>Escalation</i>	<i>E13</i>	<i>1.2%</i>		<i>u</i>	u) this is heat rate and is a GT standard specification (CL3, file 16)	
<i>r</i>	<i>Natural Gas Price</i>	<i>K21</i>	<i>239</i>		<i>v</i>	v) this is the capacity of the boiler	
<i>s</i>	<i>Escalation</i>	<i>E21</i>	<i>2%</i>		<i>w</i>	w)Reduction of Furnance : see in CL3 , point 11	
<i>t</i>	<i>Water & Other Variable Costs</i>	<i>E23</i>	<i>2.20\$ / ton</i>		<i>x</i>	x) Furnace Oil Price : PTT's Prices Assumption for Corporate Plan 2007-2011	
<i>u</i>	<i>Natural Gas</i>	<i>E37</i>	<i>2728 MBTU/Hr</i>		<i>y</i>	y) HSFO MOPS ; refer to actual selling price at investment decision	
<i>v</i>	<i>Water & Other Variable Costs</i>	<i>E39</i>	<i>420 T/H of steam</i>				
<i>w</i>	<i>Reduction of Furnace Oil</i>	<i>F44</i>	<i>658 MT/day</i>				
<i>x</i>	<i>Furnace Oil Price</i>	<i>K42</i>	<i>314</i>				
<i>y</i>	<i>HSFO MOPS</i>	<i>F43</i>	<i>-7.5 \$/MT</i>				

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<i>z</i>	<i>Natural Gas Demand charges</i>	<i>E82</i>	<i>1.75%</i>		<i>z</i>	z) Natural Gas Demand Charges : Refer to Demand Charge formula as specified in Item 2 of attachment No.3 in Natural Gas supply agreement
<i>A</i>	<i>Labour Cost</i>	<i>K85</i>	<i>=0.8*20/36</i>			
<i>B</i>	<i>Labour cost escalation</i>	<i>E85</i>	<i>6%</i>		<i>A</i>	
<i>C</i>	<i>Overhead Expense</i>	<i>E86</i>	<i>90% of labour cost</i>		<i>B</i>	
<i>D</i>	<i>Admin.</i>	<i>K87</i>	<i>=10/36</i>		<i>C</i>	
<i>E</i>	<i>Admin. Expenses escalation</i>	<i>E87</i>	<i>3%</i>		<i>D</i>	
<i>F</i>	<i>Maintenance escalation</i>	<i>E88</i>	<i>5%</i>		<i>E</i>	
<i>G</i>	<i>Insurance escalation</i>	<i>E89</i>	<i>3%</i>		<i>F</i>	
<i>H</i>	<i>Legal Reserve</i>	<i>C121</i>	<i>5%</i>		<i>G</i>	
<i>I</i>	<i>Dividend payment</i>	<i>C122</i>	<i>40%</i>		<i>H</i>	
Provide authentic evidences for the parameters in the above table.					<i>I</i>	H) Legal Reserve : Refer to Civil and Commercial Law Code 1202 from http://www.krisdika.go.th/
						I) Dividend payment ; refer to The Dividends payment of Electricity Generating Public Company Limited (Avg.2005&2006) in Stock Exchange of Thailand.
					PP Response 2: The following evidences are attached for the open points above.	
					1) Third party cross check for the O&M	

* MoV = Means of Verification, DR= Document Review, I= Interview

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		cost including insurance for 'i, j, A to G' 2) sale price of the HSFO MOPS for 'y'	
23. Submit the revised financial excel sheet as per the latest and active version of the "Guidelines on the assessment of investment analysis" available on the UNFCCC website.		The financial analysis excel sheet is revised as per the latest version 05 (EB62, Annex 5) of guidelines.	The financial analysis excel sheet and PDD are now revised as per the latest version 05 (EB62, Annex 5) of guidelines.

<u>CL 4</u> Please provide details of <ul style="list-style-type: none"> Number of operating hours of baseline steam boilers and Quantity of oil (FO, propane, diesel and butane) consumed by the individual boilers during its operation. 	B.2.2	1) The annual operating hours of the baseline steam boilers is taken from one year historic average operations (log sheets and SGDB Report). (Refer Att. CL3, file 3) 2) Quantity of fossil fuels oils is also taken from three years historic average operations (SAP system (ERP) and SGDB report). These log sheets and SCADA records for three years are submitted to the DOE.	The log sheets and SCADA records for three years are now submitted for validation, hence this CL is resolved. <u>Conclusion:</u> CL 4 Closed
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<u>CL 5</u> Please clarify, In pre-project scenario, it is mentioned that "the steam demand was being met by in-house coal and oil (FO, propane, diesel and butane) fired	B.2.5	As per the baseline methodology AM0048, V. 03, project boundary includes the site of the project facility(s) and the sites of all project customer(s). In pre-project scenario as detailed in the flow diagrams in Section A.4.3 of the PDD, PP was operating fossil fuel oil based	Clarification on the pre-project scenario and project boundary given by the PP is acceptable, hence this CL is resolved.
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<p>boilers and about 100 MW electricity import from the grid. Two coal based cogen units also exist in the plant and will continue their operations unaffected by the implementation of the CDM project activity. For the same reason, this is not included in the project boundary”.</p>		<p>boilers for steam and was also importing electricity from the grid. These both energy sources will be displaced by the CDM project activity.</p> <p>However, an existing coal based cogen plant that was supplying steam and electricity to the existing process plant will continue to operate unaffected after the project activity implementation.</p> <p>Thus, the existing coal based power plant that is not affected by the implementation of the CDM project is kept out of the project boundary and hence monitoring.</p>	<p><u>Conclusion:</u> CL 5 Closed</p>
<p><u>CL 6</u></p> <p>Please clarify, in Section B 7.1 of the PDD; value of the following not provided</p> <ul style="list-style-type: none"> Capacity of the electricity generating equipment ‘n’ existing at IRPC previous to the implementation of the project activity Total electricity self-generated by IRPC during year ‘y’ of the crediting period 	<p>D.6.2</p>	<p>1) This is mentioned as ‘0’ (zero) as there was no electricity generating capacity in the project boundary in the pre-project scenario. Only the steam generating boilers were operating in pre-project scenario.</p> <p>2) This parameter is also mentioned as ‘0’ (zero) as there is no plan from IRPC to implement a new power plant to displace electricity from the CDM project activity. Also, as covered in the earlier point (1) above, there was no existing electricity</p>	<p>Clarification given by the PP for not providing a value in some of the parameters in section B 7.1 of the PDD acceptable, hence this CL is resolved.</p> <p><u>Conclusion:</u> CL 6 Closed</p>

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<ul style="list-style-type: none"> Quantity of LNG consumed in the year 'y' in the project facilities and Quantity of natural gas consumed per fuel type 'k' in the year 'y' in the project facilities <p>And include accuracy class of all the meters used in the project activity.</p>		<p>generating equipment and hence this is kept zero for now. This parameter is also proposed to be monitored, if any electricity generation takes place by IRPC (to displace electricity from CDM project activity).</p> <p>3) CDM project activity is presently using natural gas only and no LNG. Thus, this parameter is kept zero. However, a provision is for its monitoring in case it is used in future for some reason.</p> <p>4) This quantity was provided in comment in energy terms. Now, this is also provided in m³ terms as per parameter requirements</p> <p>All monitoring tables are updated to include the accuracy class of the individual meters</p>	
<p><u>CL 7</u></p> <p>In section B.7.2, of the PDD there is no mention of emergency preparedness plan for cases where emergencies can cause unintended emissions.</p>	<p>D.6.4</p>	<p>The emergency preparedness plan is provided in the revised PDD; section B.7.2 to account for emergencies that can cause unintended emissions. The fuels used and steam and electricity generated in the project activity plant is also cross checked with the third party invoices like PTT gas bills, customer steam and electricity purchase records.</p>	<p>In section B.7.2, of the revised PDD now there is mention of emergency preparedness plan for cases where emergencies can cause unintended emissions.</p> <p><u>Conclusion:</u> CL 7 Closed</p>

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<p><u>CL 8</u></p> <p>Please provide the identified procedures for maintenance of monitoring equipments, calibration of equipments and calibration intervals/frequency.</p>	D.6.5	<p>All monitoring tables are updated to give procedures for the maintenance of monitoring equipments, calibration of equipments and calibration frequency.</p>	<p>All monitoring tables in section B.7.2, of the revised PDD are now updated to give procedures for the maintenance of monitoring equipments, calibration of equipments and calibration frequency, hence this CL is resolved.</p> <p><u>Conclusion:</u> CL 8 Closed</p>
<p><u>CL 9</u></p> <p>As the project is not commissioned, include a process flowchart indicating relevant monitoring equipments and items in section B.7.1 of the PDD.</p>	D.6.6	<p>The section B.7.1 of the PDD is provided to include a process flow chart indicating position of monitoring equipments.</p>	<p>A process flow chart indicating position of monitoring equipments has been included in section B.7.2, of the revised PDD, hence this CL is resolved.</p> <p><u>Conclusion:</u> CL 9 Closed</p>
<p><u>CL 10</u></p> <p>It is not evident from the PDD that review of the reported results/data will be done before data is submitted for verification, internally or externally (eg. Performance report).</p>	D.6.7	<p>The review of monitored data will be done as part of regular supervisory operational procedures. The log sheets are filled in by the respective operators and verified by supervisors/ shift engineers. This further goes to higher management as part of the performance reporting and is also cross checked with other records like central</p>	<p>Section B.7.2, of the revised PDD now includes the QA/QC procedures, hence this CL is resolved.</p> <p><u>Conclusion:</u></p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
		control room and invoices from gas supplier/ project customers.	CL 10 Closed
<u>CL 11</u> Procedures for possible monitoring data adjustments and uncertainties are not clear (i.e., procedure to deal with erroneous measurement, identified corrective actions if the erroneous measurement would take place during the operation of the project).	D.6.9	The QA/QC procedures in cases of data adjustments for erroneous data reports are also presented in the revised PDD, Section B.7.2.	QA/QC procedures are now included in section B.7.2, of the revised PDD, hence this CL is resolved. <u>Conclusion:</u> CL 11 Closed
<u>CL 12</u> The identified environmental impacts of the project activity along with the measures taken to mitigate the impacts and the conclusions are not enumerated in the PDD. Clarify	E.1.5	Section D.1 has given summary of the environmental impacts and Section D.2 has given mitigation measures as recommended in the third party done EIA study. A summary of this report is also provided to the DOE.	Section D.1 of the revised PDD, now has a summary of the environmental impacts and section D.2 has given mitigation measures as recommended in the third party done EIA study. Hence this CL is resolved. <u>Conclusion:</u> CL 12 Closed
<u>CL 13</u> Please clarify, In section E.2 of the PDD (page no.43) to the query raised by Ms. Phanumas Wuthiananchai, the PP has replied by telling the capacity for the plant to be 220MW.	F.1.4	This was a generic response to local stakeholders' query during the meeting for their understanding. This was wound off value from the actual installed 227.832 MW under the project activity.	The clarification provided by the PP on the capacity of the project activity is acceptable, hence this CL is resolved. <u>Conclusion:</u> CL 13 Closed

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p>CL 14</p> <p>Please clarify;</p> <p>a) In section B.4 of PDD, most plausible alternatives of baseline scenario has been analysed as per the methodology and the available alternatives have been listed out as under.</p> <ol style="list-style-type: none"> 1. Project activity (new natural gas based cogen unit) taken without CDM 2. Continuation of existing scenario – onsite FO based steam generation and for electricity mix of onsite generation and grid purchase 3. Project customer could have switched to higher GHG intensive fuel – coal <p>However, PP has not indicated /identified the economically most attractive baseline scenario alternative in quantitative terms.</p> <p>Without a comparative financial index how PP is concluding that alternatives 1 and 3 will not be attractive compared to option 2. Further PP's attention is drawn to the following clause step 2 Investment analysis of methodology AM0048 version 3 EB 52 reproduced below.</p> <p><i>If using investment analysis, internal rate of return</i></p>	<p>B.2.1</p>	<p>a) The PDD is modified for following discussion -</p> <p>Both the alternatives 1 and 3 require capital investment for these new power plants and thus will not be financially attractive compared to no project scenario option 2 – continuation of existing scenario. Thus, continuation of existing scenario is the baseline scenario and no project scenario being baseline is further substantiated in following Section B.5 by investment analysis using benchmark analysis.</p> <p>PP response 2: As per last para on pg. 3 of the methodology, "Assessing potential for fuel switch: for all project customers, the project proponent should assess the potential of fuel switching under the baseline scenario. The project proponent first determines if fuel changes are technically feasible using existing baseline</p>	<p>In the section B.4 of the revised PDD, the PP has excluded all other alternatives and kept only one alternative as baseline. Hence this query is closed</p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p><i>(IRR) of all the alternatives shall be estimated and compared to assess additionality. If the IRR of the implementing project activity without CDM is less than the other alternatives and less than accepted benchmark for rate of return within the country, then the implementation of project facility is additional</i></p> <p>PP shall justify considering the above stipulations in the methodology</p> <p>If fuel switch option is not available, Why the following plausible alternative (Alternative 3) is mentioned. "Project customer could have switched to higher</p>		<p>equipment/processes. Is the existing equipment capable of utilizing more than one fuel, without major capital investment? This can then be verified during project validation. If not, then no additional considerations need to be undertaken in the given project period and it will be assumed the same fuel would have been used as in the past."</p> <p>As per, the existing equipments and steam generation using FO and grid import for electricity demand can continue for the crediting period. Further, the existing FO based boilers can-not be modified to use any other fuel. Thus, continuation of existing scenario is a realistic baseline and same fuel would have been used as in the past. The emission reduction calculation is based on the actual three year fuel use for carbon intensity/ unit energy as per methodology.</p> <p>The above justification is also added in the revised Section B.4 of the PDD. Thus, financial analysis is not required to establish the baseline. Further, investment barrier is done using benchmark approach.</p> <p>PP response 3: The conclusion of the baseline identification in section B.4 is now updated to exclude all other alternatives</p>	

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p>GHG intensive fuel – coal”</p> <p>b) Further, reference is made to section II of the methodology which stipulates that ‘The identification of all reasonable potential alternative scenarios shall be made through interviews and/or surveys with each project customer to assess the project customer’s future energy planning (plans for switching to a less carbon-intensive fuel, plans to increase the efficiency of on-site generation, plans that influence energy demand, self-generation capacity, etc.). The objective of the interviews/surveys is to assess for each project customer the potential for changes in the type of fuel used on-site, energy efficiency, on-site generation capacity and demand levels.’</p> <p>The above compliance is not evidenced from the PDD.</p>	<p>B.2.1</p>	<p>and keep only one as baseline.</p> <p>b) The customers for steam are very small (28 TPH out of 340 TPH generated in the project activity, and rest is consumed in IRPC plant for captive consumption. This is also evident from the financial analysis sheet). These customers were buying steam from the IRPC even in the pre-project scenario. Thus, they do not have steam generation facility and no plans of setting up this facility in future considering very small demand and availability from IRPC (old steam generation plant in pre-project scenario and CDM project activity in future).</p> <p>Similarly, for the electricity sale to customers, the national grid is major customer with 65 MW capacity out of total 227.832 MW of project activity. The grid will also develop capacity but there is no specific carbon emission intensity reduction plan from the Government. The customers will use estimated 11MW electricity only and have been using electricity from the national grid in the pre-project scenario. Thus, continuation of existing fuel mix is assumed by the PP.</p> <p>Thus, any customers of the project activity do not have plans for switching to a less carbon-intensive fuel, plans to increase the</p>	<p>It is now evident from the revised PDD, that any customers of the project activity do not have</p> <ul style="list-style-type: none"> • plans for switching to a less carbon-intensive fuel and/or • plans to increase the efficiency of on-site generation and/or • plans that influence energy demand, self-generation capacity that can result in a lower emission factor and financially attractive alternative compared to the baseline established. <p>Hence this query is closed</p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion						
<p>c) In section B.4 step2 item 4- barrier analysis in PDD it is mentioned that ‘the IRPC’s industrial complex is not undergoing any change (including that in the production capacity) Thus, the energy consumption in baseline and project scenarios is the same’. However from heat/mass balance diagram in section A.4.3 following figures are seen</p> <table><tr><th>Baseline</th><th>Project activity</th></tr><tr><td>Power-100 MW</td><td>Power- 189 MW</td></tr><tr><td>Steam-450T/hr</td><td>Steam-340.415 T/hr</td></tr></table> <p>PP shall clarify on the above observations.</p>	Baseline	Project activity	Power-100 MW	Power- 189 MW	Steam-450T/hr	Steam-340.415 T/hr	<p>B.2.1</p>	<p>efficiency of on-site generation, plans that influence energy demand, self-generation capacity that can result in a lower emission factor and financially attractive alternative compared to the baseline established here. This is also discussed in the revised PDD.</p> <p>c) Please note that the Section B.4 talks about production capacity and energy demand of the IRPC refining unit. This will decide the determination of baseline is thus referred in the Section B.4.</p> <p>The DOE has pointed out difference in the pre-project and post project energy generation/ import in the project boundary. The energy balance of this is explained below.</p> <p>In baseline, 100 MW was imported from the grid. In the post project scenario, out of 189 MW generated from the 5 GTs, 100 MW will be used for captive consumption in IRPC, 65 MW will be sold to grid and rest ~ 24 MW will be sold other customers (nearby industrial units).</p> <p>Further, the steam generation was higher in baseline than in the project scenario. For this same reason, as recommended by the methodology, the CER calculation is capped (using below given formula) at the three year historic energy use as</p>	<p>The clarification and justification given by PP for the project generating less steam than in baseline is acceptable. In the revised PDD, section B.6.3 is updated to include justification for capping electricity at historic generation levels. Hence this query is closed.</p> <p><u>Conclusion:</u> CL 14 Closed</p>
Baseline	Project activity								
Power-100 MW	Power- 189 MW								
Steam-450T/hr	Steam-340.415 T/hr								

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p>In the above case of emission on account of steam production, CER Calculation is not capped (in contrast to PP's reply) at three year historic energy use as seen from the calculations. It is capped at 9,150 TJ which is steam purchased by the project customer i from the proposed project facility j in year y (tonnes) is assumed equivalent to steam generation capacity of the project activity i.e. 408.5 TPH or 3,267,984 ton/ year. However in the case of $EL_{BL,j,i,y}$, CER is capped at three year historic energy. PP shall comment/clarify on this.</p>		<p>discussed in Section B.6.3 of the PDD and CER calculation sheet.</p> $SC_{BL,j,i,y} = \min(SC_{PJ,j,i,y}, SC_{MG,i} - SC_{PCSG,i,y})$ <p>PP response 2: Please note that $SC_{PJ,j,i,y}$ is lower (9,250 TJ) than the $SC_{MG,i}$ (Total historical capacity of steam generation of the equipment existing at project customer – 9,392 TJ). This is due to the fact that pre-project steam generation capacity was 450 TPH (refer assumptions sheet in CER calculations) higher than the project activity steam generation capacity 408.5 TPH. Now, further if the existing equipment is used, this will be monitored as $SC_{PCSG,i,y}$ and deducted from $SC_{MG,i}$ to arrive at $SC_{BL,j,i,y}$.</p> <p>The Section B.6.3 of the PDD is updated to include justification for capping electricity at historic generation levels and the project generates less steam than in baseline.</p>	

<p>CL 15</p> <p>Please clarify;</p> <p>In section B.6.3 of PDD-Baseline emission it is indicated that the project activity will have an installed capacity of 227.832 MW. At planned</p>	<p>E.3.4</p>	<p>The DOE has rightly pointed that emission reduction is presented for all units operational. The CER calculation and financial analysis is done for the design capacity and optimal utilization. As the project activity will include the capital cost of 6th standby units in the investment</p>	<p>The clarification on the 6th boiler unit considered for baseline emission reductions is acceptable. As the project activity has included capital</p>
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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p>8,000 annual operating hours, this will generate $EL_{BL,j,i,y} = 1,822,656$ MWh. However, in the Heat/mass balance diagram in section A.4.3 of PDD it is indicated that out of 6 units one is standby. Hence for emission calculations only 5 nos are to be accounted which works out to 1518880 MWh ($37.972 \times 5 \times 8000$).</p> <p>$S_{PJ,j,i,y}$ i.e. steam purchased by the project customer i from the proposed project facility j in year y (tonnes) is assumed equivalent to steam generation capacity of the project activity i.e. 408.5 TPH or 3,267,984 ton/ year. Here also 408.5 TPH is for 6 units. For 5 units it works out to 340.415 TOH (68.083×5).</p> <p>Further, PP has also confirmed in their response referred in Appendix A that only 5 units are in operation and one unit is always standby.</p> <p>This being the case, PP shall clarify whether to consider baseline emission calculations based on 6 units or 5 units operation.</p>		<p>analysis, the energy and revenue from same is also used in the analysis. Thus, this is conservative analysis. This will also result in no deviation/ revision of monitoring plan later if PP uses stand by units routinely for a short period in some monitoring period.</p>	<p>cost of 6th standby units in the investment analysis, the energy and revenue from same is also used in the analysis. Thus, this is conservative analysis. This will also result in no deviation/ revision of monitoring plan later if PP uses stand by units routinely for a short period in some monitoring period. Hence this query is closed.</p> <p><u>Conclusion:</u> CL 15 Closed</p>
<p>Auxiliary power consumption is not indicated in the calculations.</p>	<p>E.3.4</p>	<p>The Auxiliary consumption is not taken separately in CER calculation as well as the financial analysis. The PP could use stand by GT unit for supplying to auxiliary need of the CDM project activity. Thus, the net electricity is not reduced in the CER calculation or the financial analysis on account of auxiliary consumption. This is requested to be accepted as a conservative approach.</p>	<p>In the revised CER calculation sheets now from the net electricity generation auxiliary consumption is deducted. The clarification by PP for the conservativeness of the CER calculation is acceptable. Hence this query is closed.</p>

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Draft report clarifications and corrective action requests by validation team	Reference Document	Summary of project owner response	Validation team conclusion
<p>Scheme of using standby GT for auxiliary power consumption may be explained in detail. PP shall justify how conservativeness is achieved if auxiliary power consumption is not considered in CER calculations.</p> <p>In respect of auxiliary power consumption, conservative approach is required in CER calculations also. Hence PP may suitably modify and justify the calculations.</p>		<p>PP response 2: The auxiliary consumption is also not accounted in the financial analysis thus showing higher revenue and conservative financial analysis. Thus, to use consistent energy output in the financial analysis and CER calculation, the total generation is used in the CER calculation. If required, the auxiliary consumption can be considered both in the CER calculation and financial analysis.</p> <p>PP response 3: Now a calculation is shown to calculated auxiliary consumption and deduct this to calculate net electricity generation. However, as the electricity for CER calculation is determined by historic data (which is still lower than the electricity generated from project after deducting auxiliary consumption), there is no impact on CERs estimated.</p>	<p><u>Conclusion:</u> CL 15 Closed</p>
<p><u>FAR 1</u></p> <p>For applicability condition no.5, it is mentioned as "The equipment displaced by the project activity will not be sold or used for other purposes. These are either scrapped or retained as stand by units". If used as stand by unit then, monitor and capture under project activity and leakage.</p>		<p>All the existing units displaced by the project activity are proposed to be scrapped and thus are not included in the project boundary. A letter from PP to the regulatory authority asking for permission to discontinue boilers is being submitted now.</p>	<p>Shall be further verified by the DOE during 1st verification.</p> <p><u>Conclusion:</u> FAR 1 Open</p>

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		PP Response 2: PP has initiated the process of scrapping the existing boilers. For the same, he has sent application to the concerned authorities to allow stopping use and disconnecting the boilers from the system. These letters are attached in original and English translations. In the next stages on getting these approvals, the boilers will be disconnected and scrapped. Please refer attachment 'FAR 1 - Boiler utilization cancellation applications - Eng and Thai'	

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APPENDIX B
AUDITOR'S CERTIFICATE

Sijil Certificate

This is to certify that

AERNIDA ABDUL KADIR

has been qualified as

**LEAD AUDITOR
FOR
CDM VALIDATION AND VERIFICATION SCHEME**

in accordance with the relevant provisions of SIRIM QAS International's CDM procedure

Sectoral Scope No: 1 – Energy industries (renewable/non-renewable sources)

TA 1.1 – Thermal energy generation from fossil fuel and biomass including
thermal electricity from solar (COMPLEX)

TA 1.2 – Energy generation from renewable energy sources.

Sectoral Scopes No: 13 – Waste handling and disposal

TA 13.1 Waste handling and disposal.



Parama Iswara Subramaniam

Chairman

Auditor Evaluation Panel

Management System Certification Department

SIRIM QAS International Sdn. Bhd.

Initial Qualification Date : **13 April 2011**

Sijil Certificate

This is to certify that

DR. D. SIDDARAMU

has been qualified as

**LEAD AUDITOR
FOR
CDM VALIDATION AND VERIFICATION SCHEME**

in accordance with the relevant provisions of SIRIM QAS International's CDM procedure
Sectoral Scopes No. : 1 – Energy industries (renewable/non-renewable sources)

TA 1.2 – Energy generation from renewable energy sources.



Parama Iswara Subramaniam
Chairman
Auditor Evaluation Panel
Management System Certification Department
SIRIM QAS International Sdn. Bhd.

Qualification Date : **9 November 2011**