VALIDATION OPINION

for Post Registration Changes

Mokpo Landfill Gas Recovery Project for Electricity Generation

UNFCCC Ref. No. 2834

REPORT NO. 2013-10

VERSION 01.1

KOREAN FOUNDATION FOR QUALITY

Date of first issue:	Date of this revision	Project No.:
29 November 2013	5 December 2013	COP-175
Approved by: Yu Shim JEONG Date : 6 December 2013		Organisational unit: Korean Foundation for Quality (KFQ)
Client: Hanwha Corporation		Client ref.: Mr. Jae Hong PARK

Korean Foundation for Quality

13F, Woolim Lion's Valley B Bldg. 371-28 Gasan-dong, Geumcheon-gu, Seoul, Korea
Tel. +82 2 2025 9061
Fax. +82 2 2025 9069
http://www.kfq.or.kr

Summary:

Subject: Validation opinion for post registration changes

Project Title: Mokpo Landfill Gas Recovery Project for Electricity Generation/ ref. 2834

Sectoral scopes:

1 : Energy industries (renewable - / non-renewable sources)
13 : Waste handling and disposal

Applied Methodology(Ver.) :

AMS I. D: Grid connected renewable electricity generation (version 13)
AMS III. G: Landfill methane recovery (version 06)

Validation of the changes was conducted:

☐ Prior to commencement of a verification for the project activity or PoA stated above

■ When performing verification for the project activity or PoA stated above.
(Monitoring period 19/08/2012~18/08/2013_4th verification)

Type of post registration change:

☐ Temporary deviations from the registered monitoring plan and/or monitoring methodology

■ Corrections

☐ Change to the start date of the crediting period

■ Permanent changes from the registered monitoring plan or monitoring methodology

☐ Changes to the project design of a registered project activity

Prior approval by CDM EB is required:

☐ Yes ■ No

Work carried out by :	Work verified by :
Eun Jung KIM (Audit team leader, GHG auditor) Jin Seok CHO (Auditor team member, GHG auditor)	Sung Han YOON

Abbreviations

AMS	Approved Small Scale Methodology
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide Equivalent
DOE	Designated Operational Entity
ER(s)	Emission Reduction(s)
EB	Executive Board
GHG	Greenhouse gas(es)
KESCO	Korea Electrical Safety COrporation
KFQ	Korean Foundation for Quality
KPX	Korea Power eXchange
MP	Monitoring Plan
MR	Monitoring Report
PDD	Project Design Document
PP	Project Participant
UNFCCC	United Nations Framework Convention for Climate Change
VVS	Clean Development Mechanism Validation and Verification Standard

Table of Contents ***Page***

1 INTRODUCTION 3
1.1 Objective 3
1.2 Scope 3
1.3 GHG project description 4
1.4 Validation Team 4

2 METHODOLOGY 5
2.1 Desk Review of the Documents 5
2.2 Follow-up Discussions with Project Stakeholders 5
2.3 Interal Quality Contorol 5

3 VALIDATION FINDINGS 6
3.1 Temporary deviations from the registered monitoring plan and/or monitoring methodology 6
3.2 Corrections 6
3.3 Permanent changes from registered monitoring plan or monitoring methodology 13
3.4 Changes to the project design of a registered project activity 18

4 VALIDATION OPINION 21

5 REFERENCES 22

Appendix: Qualification of Validation Team & Technical Reviewer

1 INTRODUCTION

Korean Foundation for Quality (KFQ) has been engaged by Hanwha Corporation to perform a validation for post registration changes of "Mokpo Landfill Gas Recovery Project for Electricity Generation (UNFCCC Registration Ref. No. 2834)". This validation opinion summarizes the findings and/or opinions for post registration changes, performed on the basis of UNFCCC criteria as well as applied methodology AMS I.D: Grid connected renewable electricity generation (version 13) and AMS III.G: Landfill methane recovery (version 06).

1.1 Objective

In accordance with paragraph 62(g) of the CDM Modalities and Procedures, the DOE contracted by the project participant to perform verification shall, "Identify and inform the project participants of any concerns relating to the conformity of the actual project activity and its operation with the registered project design document. Project participants shall address the concerns and supply relevant additional information." Also, in accordance with paragraph 57 of the CDM Modalities and procedures, it allows project participants to revise MPs in order to improve accuracy and/or completeness of information, subject to the revision being validated by a DOE.

The purpose of the post registration changes is to have an independent third party assessment in regard to the changes from the actual project activity as described in the registered PDD and level of accuracy or completeness in the proposed revision of the MP and the conformity with approved monitoring methodology.

1.2 Scope

The validation scope is defined as an independent and objective review of the revised PDD, other relevant documents and on-site inspection. The information in these documents is reviewed against the applied methodologies (AMS-I.D Version 13, AMS-III.G Version 6) and relevant decisions by the CDM Executive Board.

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

1.3 GHG Project Description

The project was registered on 18 February 2010 under UNFCCC Ref. No. 2834 based on the registered PDD (version 04, dated on 27 November 2009) and the revised monitoring plan was approved on 19 January 2011[1].
The current status of the project is that 1st~3rd monitoring (18/02/2010~18/08/2012) were issued, and the validation team is performing the 4th monitoring (19/08/2012~18/08/2013).

During 4th monitoring period, new watt hour meter for measuring exported electricity was installed for 2nd generator as per national regulation. Accordingly, the PP is not able to implement project monitoring as per the revised monitoring plan. Thus, the PP revised the PDD in order to reflect the actual project monitoring.

1.4 Validation Team

The validation team consisted as follows:

Eun Jung KIM (Audit team leader)
Jin Seok CHO (Audit team member)

Technical review was undertaken by a technical reviewer, Sung Han YOON

The qualification of each individual validation team member is detailed in Appendix to this report.

2 METHODOLOGY

2.1 Desk review of the Documents

The revised PDD submitted by the client and additional background documents related to further monitoring aspects were reviewed as initial step of the validation process as for the post registration changes.

[1] http://cdm.unfccc.int/Projects/DB/emc1249265030.9/view

2.2 Follow-up discussion with Project Stakeholders

KFQ performed a physical site inspection on 20 August 2013, and performed the follow-up discussion with the project stakeholders to confirm selected information and to resolve issues identified in the document review. The main topics of the discussion are summarized in the table below.

Discussed organisation	Discussion topics
Hanwha Corporation - Kun Hong LEE - JIN Young CHOI Econetwork Co., Ltd (Consulting company) - Seon Young MOON - Yeah Won KIM	➢ Project Implementation and operation ➢ Changes to monitoring plan ➢ Monitoring parameters listed in the PDD and revised MP ➢ Installation of electricity meter and monitoring
KPX (Korea Power eXchange) - Yong Hoe HUH	➢ Installation of electricity meter and monitoring ➢ National regulation (On-line interview)

2.3 Internal Quality Control

According to KFQ's Procedure for deciding whether to proceed with a request for post-registration changes, the validation opinion undergoes a technical review before submitting a request for post registration change. The technical review is performed by a technical reviewer qualified in accordance with KFQ's qualification scheme for CDM validation and verification.

3 VALIDATION FINDINGS

3.1 Temporary deviations from the registered monitoring plan and/or monitoring methodology

N/A

3.2 Corrections

3.2.1 Description of the corrections

Corrections described in Table 1 below are assessed for the post registration change.

Table 1. Corrections

	Section	Registered PDD	Revised PDD
1	Description of the small-scale project activity: (A.2)	<table><tr><th>Date</th><th>Project Schedule</th></tr><tr><td>April 2009</td><td>Expected date of additional 1.058MW generator</td></tr></table> Source: Hanwha official report (April 2008)	<table><tr><td>Date</td><td>Project Schedule</td></tr><tr><td rowspan="2">**June** 2009</td><td>**Starting date of commercial operation (electricity sales to KEPCO)**</td></tr><tr><td>**D**ate of additional 1.058 MW generator installation</td></tr></table> Source: Hanwha official report (April 2008, **2009**)
2	Location of the project: Region (A.4.1.2)	Daeyang-dong	**Jeollanam-do**
3	Location of the project: Details (A.4.1.4)	The coordinates are longitude of 34:48 N and latitude of 126:22 E.	The coordinates are latitude of **34.8328** and longitude of **126.4096**. **The coordinates are based on the power plant.**
4	Type and category(ies) and technology /measure (A.4.2)	~ one additional generator with capacity of 1.058 MW will be added in April 2009 (expected date).	~ one additional generator with capacity of 1.058 MW **was** added in **June** 2009.
5	Data and parameters monitored: (B.7.1)	Registered monitoring plan (version 04, dated on 27 November 2009) - W_x, $p_{n,j,x}$, z, T, and P parameters were included - 'Data unit' and 'any comment' of $LFG_{electricity,y}$ parameter: m3/y	Described as per revised montoring plan (approved on 19 Jan 2011) - **W_x, $p_{n,j,x}$, z, T, and P parameters were excluded** - 'Data unit' and 'any comment' of $LFG_{electricity,y}$ parameter: **N**m3/y, **No separate monitoring of temperature and pressure when expressing LFG volumes in normalized cubic meters**
6	Data and parameters monitored: GWP_{CH4} (B.7.1)	Value of data: 21(to be applied for the first commitment period of the Kyoto Protocol)	Value of data: 21(to be applied for the first commitment period of the Kyoto Protocol) **25(to be applied for the secondary commitment period of the Kyoto Protocol)**
7	Data and parameters monitored: $W_{CH4,y}$ (B.7.1)	Brief description of measurement methods and procedures to be applied: - Linearity is +/- 0.5% of F.S - Zero drift is +/- 1% of F.S	Brief description of measurement methods and procedures to be applied: - Linearity is +/- **1**% of F.S - Zero drift is +/- **2**% of F.S

8	Annex 1 Contact Information	Organization: Hanwha Corporation Street/P.O.Box: #1 Janggyodong, Junggu Building: 22F, Hanwha Bldg. City: Seoul State/Region: Postfix/ZIP: 100-797 Country: Republic of Korea Telephone: +82-2-729-3532 FAX: +82-2-729-3697 E-Mail: jcc@hanwha.co.kr URL: http://english.hanwhacorp.co.kr/ Represented by: Cheon chae, Jeong Title: Deputy Senior Manager Salutation: Mr. Last Name: Jeong Middle Name: First Name: Cheonchae Department: Trade Division, Business Development Department Mobile: Direct FAX: Direct tel: Personal E-Mail:	Deleted

3.2.2 Assessment of the corrections

1. Update description on 1.058MW generator (1 & 4 in Table 1)

Expected date of an additional 1.058MW generator (2nd generator) is described as April 2009 in the registered PDD. As the 1.058MW generator started commercial operation in June 2009, the PP updated the description in A.2 and A.4.2.

The validation team confirmed through commissioning certificate from KESCO.

2. Correct error on the location (2 & 3 in Table 1)

The site of the "Mokpo Landfill Gas Recovery Project for Electricity Generation" is located in Daeyang-dong, Mokpo City, Jeollanam-do, Republic of Korea as described in the registered PDD. It was found that Region/State/Province of the Location of the project activity in A.4.1.2 has been mistakenly described as Daeyang-dong and correctly revised as Jeollanam-do.

The GPS coordinates in the A.4.1.4 of registered PDD is mistakenly applied and is corrected to latitude of 34.8328 and longitude of 126.4096 based on the power plant. The validation team checked the geographic coordinates with the site address in google earth and confirms that latitude of 34.8328 and longitude of 126.4096 based on the power plant are correct.

3. Update monitoring plan as per revised monitoring plan (5 in Table 1)

Revised monitoring plan was approved on 19 January 2011 and the revised PDD is corrected as per the revised monitoring plan: W_x, $p_{n,j,x}$, z, T, and P parameters were excluded, Data unit of $LFG_{electricity,y}$ parameter is changed from m^3y to Nm^3/y, etc. The validation team confirms that the revised PDD is correctly updated in accordance with the revised monitoring plan.

4. Update GWP_{CH4} (6 in Table 1)

Value for GWPCH4 is described as 21 for the first commitment period in the registered PDD and 25 for the second commitment period is added in the revised PDD. The validation team confirms that GWPCH4 of 25 for the second commitment period is in accordance with decision 4/CMP 7.

5. Correct error on gas analyser for W_{CH4}

The specification of gas analyzer was wrongly described in the registered PDD. It was found during the 1st verification by KFQ[1]. The validation team checked the specification of the gas analyzer and confirmation letter from the manufacturer (Fuji) and confirms that the linearity of +/- 1% and zero drift of +/- 2% is correct as described in the revised PDD.

6. Update contact information (8 in Table 1)

Two personnels were described in Annex I of the registered PDD. The PP revised the contact information and deleted not valid information.

Thus, it is confirmed that the change does not require prior approval by the Board in accordance with appendix 1 of Project standard.

The validation team confirms the corrections amended in the revised PDD are accurate reflections of actual project information and are in accordance with the applied methodologies.

3.3 Permanent changes from the registered monitoring plan or monitoring methodology

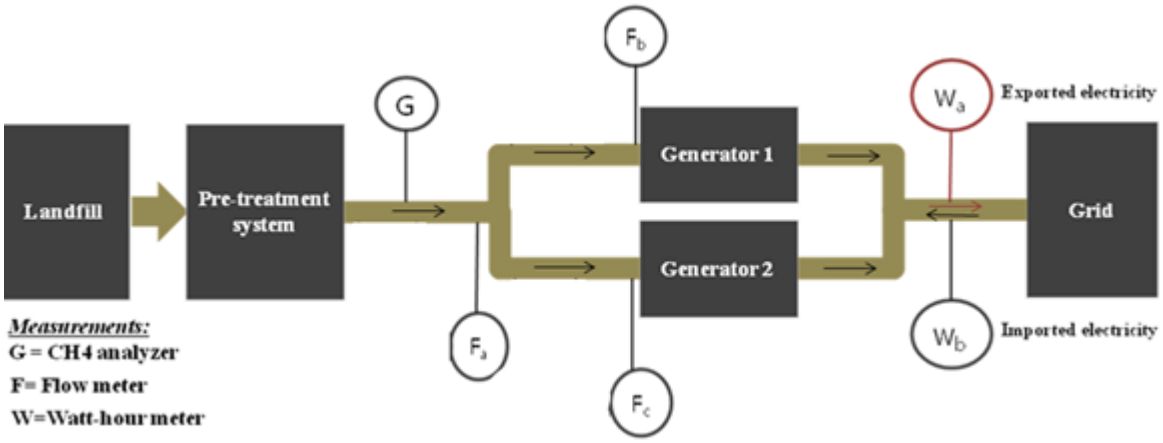
3.3.1 Description of the revision of the monitoring plan in the revised PDD

According to the approved revised monitoring plan (approved on 19 January 2011), total amount of electricity exported out of the project ($EL_{EXP,PJT,y}$) is measured by watt-hour meter (Wa) as described in the revised monitoring plan, <Figure 1>.

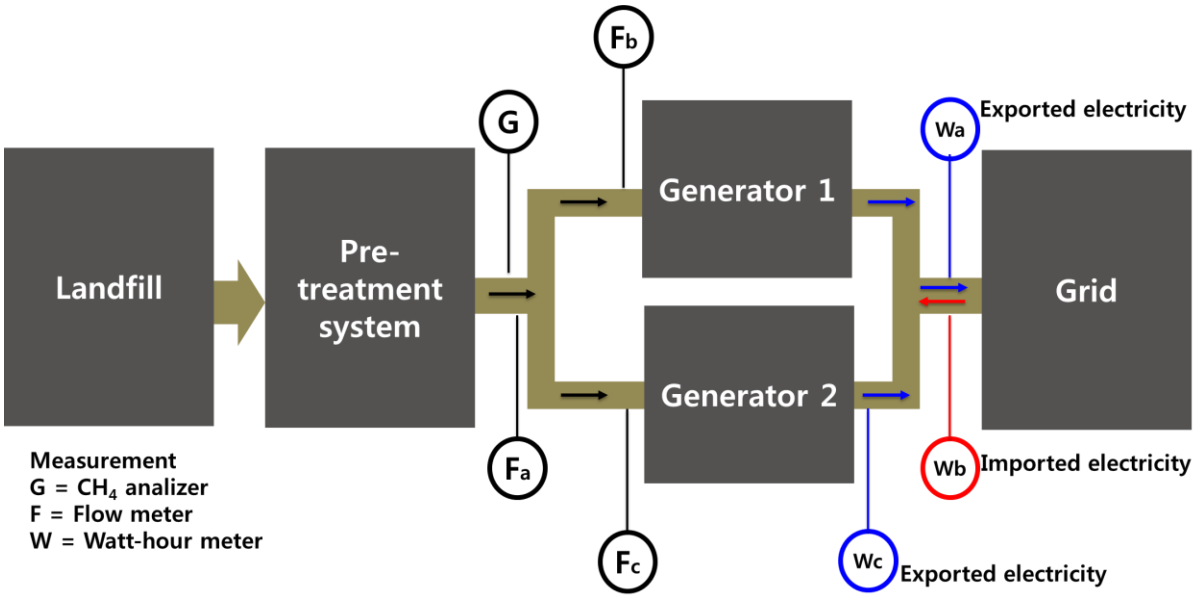
During the 4th monitoring period, a new watt hour meter (Wc) for measuring exported electricity was installed next to the 2nd generator on 27 January 2013 and has been used since 30 January 2013.

As described in the revised monitoring diagram, <Figure 2>, Wa measures generated electricity from 1st and 2nd generators; Wc measures generated electricity from 2nd generator.

[1] For details, please refer to CAR 6 of the verification report for 1st monitoring period.



<Figure 1> monitoring diagram in registered monitoring plan



<Figure 2> Revised monitoring diagram in this post-registration change

3.3.2 Assessment of the revision of the monitoring plan in the registered PDD

The existing meter (Wa) was measuring exported electricity from both 1st generator and 2nd generator. As per national regulation, "Act on the promotion of the development, use and diffusion of new and renewable energy", the electricity generation from 1st generator and 2nd generator should be measured separately because the commercial operation starting date is different[1]. Accordingly, the PP is requested to measure the electricity generation separately and the PP installed new meter (Wc) to measure electricity from 2nd generator in attendance with KPX, the grid company. The validation team reviewed the national regulation and the official document and confirms that the installation of Wc is not within the control of PP.

[1] 1st generator started commercial operation in September 2008 and 2nd generator started commercial operation in June 2009.

Thus, it is confirmed that the change does not require prior approval by the Board in accordance with appendix 1 of Project standard.

Accordingly, the revised monitoring plan of $EL_{EXP,PJT,y}$ is applied from 30 January 2013 as follows.

As described in the revised monitoring diagram, <Figure 2>, Wa measures electricity from 1st and 2nd generators; Wc measures electricity from 2nd generator.
When only 1st generator operates or 1st and 2nd generator operate together, the exported electricity is measured by Wa; when 2nd generator operates, the exported electricity is measured by Wc [1]. The verification team confirmed through interviewing the PP and relevant personnel in KPX.
The exported electricity will be crosschecked with sales receipt from KPX.

The validation team checked the new meter (Wc) during on-site visit and the accuracy is 0.5S, which is in accordance with the national standard, Operational Directive of Korean Electricity Market controlled by KPX requesting the accuracy of 1%. Also, the accuracy of existing meter (Wa) is 0.5S.
Thus, the validation team concluded that the applied accuracy of new meter (Wc) do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.
Also, the proposed revision does not affect ER calculation formula and accuracy and the validation team concludes that the accuracy of the calculation of emission reductions of the proposed revision is not reduced.

Based on the demonstration above, the validation team can conclude that the proposed revision is appropriate and is in accordance with the applied methodology (AMS I. D version 13 and AMS III. G version 06) .

Accordingly, the assessment of the changes (in the form of a duly completed "Post-registration changes request form" (F-CDM-PRC) and KFQ's validation opinion on the changes) is to be submitted together with the revised PDD (version 05 dated 29 November 2013) for acceptance by the CDM EB as part of the request for issuance.

[1] As for Mokpo LFG power plant, 2nd generator is used as auxiliary generator and does not operate in parallel with 1st generator. The validation team confirmed through reviewing the historical data. (Theoretically, when 1st and 2nd generators operate, the total electricity is measured by Wa.)

4 VALIDATION OPINION

Korean Foundation for Quality (KFQ) has performed a validation of the post-registration change of CDM project Ref. No. 2834: Mokpo Landfill Gas Recovery Project for Electricity Generation. The validation was performed on the basis of UNFCCC criteria for the CDM and host country criteria, as well as criteria given to provide for the consistent project operation, monitoring and reporting.

The validation is based on the information made available to us and the engagement conditions. The validation team reviewed the revised PDD and relevant supporting documents and conducted follow-up interviews to determine the fulfillment of all stated criteria. In our opinion, post-registration changes of the project activity meet all relevant UNFCCC requirements for the CDM.

Furthermore, we confirm that the revised MP ensures that;

(a) The level of accuracy and completeness in the monitoring and verification process is not reduced as a result of the revision.

(b) It is in accordance with the approved monitoring methodology applicable to the project activity.

Also, we confirm that the proposed changes of project activity do not impact;

(a) The additionality of the project activity

(b) The scale of CDM project activity

(c) The applicability and application of approved baseline methodology under which the project activity has been registered

(d) The compliance of the monitoring plan with the applied monitoring methodology

Therefore, KFQ requests the approval of post-registration changes of the project activity as justified above.

Signed on behalf of the Korean Foundation for Quality

Signature : 

Name : Yu Shim JEONG

Date : 6 December 2013

5. REFERENCES

1. PDD of 'Mokpo Landfill Gas Recovery Project for Electricity Generation' (UNFCCC Reference No. : 2834), (version 04, 27 November 2009)
2. Revised PDD of 'Mokpo Landfill Gas Recovery Project for Electricity Generation' (version 05, 29 November 2013)- Track version
3. Revised PDD of 'Mokpo Landfill Gas Recovery Project for Electricity Generation' (version 05, 29 November 2013)- clean version
4. Final Validation Report, Environmental Management Corporation, Report No. 08-001 (Revision No. 08, 17th February 2010)
5. Validation report of revised monitoring plan , Korean Foundation for Quality, (Report No. 2010-09, Version NO. 01)
6. Final Monitoring report for 1^{st} ~3^{rd} Monitoring period
7. Final ER calculation sheet for 1^{st} ~3^{rd} Monitoring period
8. Final Verification report for 1^{st} ~3^{rd} Monitoring period
9. Clean development mechanism validation & verification standard (Version 04.0)
10. Clean development mechanism project standard (Version 02.1)
11. Clean development mechanism project cycle procedure (Version 04.0)
12. Operating Manual – Mokpo LFG Power Plant-Monitoring (Version: 14), 01 October 2013
13. Official Document on new watt-hour meter, 14 March 2013, New Renewable Energy Center
14. Official Document to explain the reason for new watt-hour meter installation, 28 August 2013, KPX
15. Law No. 10445, Act on the Promotion of the Development, Use, and Diffusion of New and Renewable Energy", effective as of 1 January 2012. (Recently amended to Law No. 11965 effective as of 31 October 2013)
16. Commissioning Certificate for 2nd generator, 5 June 2009, Korea Electrical Safety Corporation
17. Law No. 11690, Law regarding Measurement, Ministry of Trade Industry & Energy, effective as of 23 March 2013
18. Initial test report for meter of electricity exported (Wc) (9 January 2013), Korea Testing Certification
19. Certificate of career for Mr. Jeong, 4 December 2013, Hanwha

Appendix

Qualification of Validation Team and Technical Reviewer

CERTIFICATE OF COMPETENCE

Name: Eun Jung KIM

Qualification:

	Validation	Verification
-Lead auditor	■	■
-Auditor	□	□
-Technical Expert	□	□
-Local Expert	□	□

Scopes of Expertise:

1.2 Energy generation from renewable energy sources

13.1 Waste handling and disposal

She is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 30 June 2013.

Sustainability Management Institute
Sang Yeon PARK

KOREAN FOUNDATION FOR QUALITY

CERTIFICATE OF COMPETENCE

Name: Jin Seok CHO

Qualification:

	Validation	Verification
-Lead auditor	■	■
-Auditor	□	□
-Technical Expert	□	□
-Local Expert	□	□

Scopes of Expertise:

Technical Area (TA)

1.2 Energy generation from renewable energy sources

He is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 30 March 2013.

Sustainability Management Institute
Sang Yeon PARK

KOREAN FOUNDATION FOR QUALITY

CERTIFICATE OF COMPETENCE

Name: Sung Han YOON

Qualification:

	Validation	Verification
-Lead auditor	■	■
-Auditor	□	□
-Technical Expert	□	□
-Local Expert	□	□

Scopes of Expertise:

Technical Area (TA)

1.1 Thermal energy generation from fossil fuels and biomass including thermal electricity from solar

1.2 Energy generation from renewable energy sources

11.2 GHG capture and destruction.

13.1 Waste handling and disposal

He is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 6 January 2012.

Sustainability Management Institute
Nam Hoon KIM