Validation Report
(including DOE Assessment Opinion)

VALIDATION OF TEMPORARY CHANGES FROM THE REGISTERED MONITORING PLAN OF:
“Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan”

UNFCCC 3555-CDMP

Report No. 600501091

02 November 2012

TÜV SÜD Industrie Service GmbH
Carbon Management Service
Westendstr. 199 - 80686 Munich – GERMANY
Validation of the CDM Project:
Validation of temporary changes from the registered monitoring plan of “Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan”

Subject: Validation of temporary changes from the registered monitoring plan of “Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan”

Accredited TÜV SÜD Unit:
TÜV SÜD Industrie Service GmbH
Certification Body “climate and energy”
Westendstr. 199 - 80686 Munich
Federal Republic of Germany

Project participants:
1) Bestway Cement Limited (Private Entity)
2) Mitsubishi UFJ Morgan Stanley Securities Co., Ltd (Private Entity)

Project Site(s):
The Project activity is located in the Bestway Cement Limited. It is located in Tatral village, 22 km Kallar Kahar – Choa Saiden Shaa Road, Chakwal, Punjab province, Pakistan. Its geographical coordinates are east longitude 72°55'28" and north latitude 32°43'14".

Applied Methodology / Version:
AMS-III.Q / Version 02

Scope(s): 1, 4
Technical area(s): 1.1, 4.1

Registered PDD (second crediting period):
dated 18-03-2010, version 1.3

Fixed Crediting Period:
28-08-2010 to 27-08-2020

UNFCCC project documentation web-link:
http://cdm.unfccc.int/Projects/DB/TUEV-SUED1269600034.75/view

Assessment Team Leader:
Mr. Mahmood, Khalid

Assessment Team Members:
Mr. Agrafiotis, Georgios
Mr. Syed Mahmood, Ali Bukhari

Technical Reviewers:
Mr. Mitterwallner, Robert
Mr. Kleiser, Thomas

Certification Body Responsible Member:
Mr. Kleiser, Thomas

Summary of the Validation Opinion:
✔ The review of the temporary changes from the registered monitoring plan and the subsequent follow-up interviews have provided TÜV SÜD with sufficient evidence to determine the fulfilment of all stated criteria. In our opinion, the temporary changes from the registered monitoring plan meet all relevant UNFCCC requirements for the CDM. Hence TÜV SÜD will recommend the replacement of the monitoring plan contained in the registered PDD by the submitted revision.

☐ The review of the temporary changes from the registered monitoring plan and the subsequent follow-up interviews have not provided TÜV SÜD with sufficient evidence to determine the fulfilment of all stated criteria. Hence TÜV SÜD will not recommend the replacement of the monitoring plan of registered PDD.
Validation of the CDM Project:
Validation of temporary changes from the registered monitoring plan of “Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan”

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### Abbreviations

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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AMS</td>
<td>Approved Small Scale Methodology</td>
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<tr>
<td>CAR</td>
<td>Corrective Action Request</td>
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<td>CDM</td>
<td>Clean Development Mechanism</td>
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<tr>
<td>CER</td>
<td>Certified Emission Reductions</td>
</tr>
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<td>CR</td>
<td>Clarification Request</td>
</tr>
<tr>
<td>DOE</td>
<td>Designated Operational Entity</td>
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<td>EB</td>
<td>Executive Board</td>
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<tr>
<td>ER</td>
<td>Emission reduction</td>
</tr>
<tr>
<td>FAR</td>
<td>Forward Action Request</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas(es)</td>
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<td>KP</td>
<td>Kyoto Protocol</td>
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<td>MP</td>
<td>Monitoring Plan</td>
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<td>MR</td>
<td>Monitoring Report</td>
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<td>PDD</td>
<td>Project Design Document</td>
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<tr>
<td>TÜV SÜD</td>
<td>TÜV SÜD Industrie Service GmbH</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<tr>
<td>VVS</td>
<td>Validation and Verification Standard (version 02.0)</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 Objective

The validation objective is an independent assessment by a Third Party (Designated Operational Entity = DOE) of temporary changes from the registered monitoring plan against all defined criteria set for the registration under the Clean Development Mechanism (CDM). Validation is required in the context of proposed revisions of a registered CDM activity and will finally result in a conclusion by the executing DOE whether the temporary changes from the registered monitoring plan are valid and should be submitted for replacing the previous version of the monitoring plan for the first monitoring period 28/08/2010-16/01/2012. The ultimate decision on the acceptance of the temporary changes from the registered monitoring plan rests at the CDM Executive Board.

The project activity discussed by this validation report is registered as CDM activity N° 3555 with the project title: “Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan”

1.2 Scope

The scope of any assessment is defined by the underlying legislation, regulation and guidance given by relevant entities or authorities. The request is complying with the requirements as they are depicted in VVS §233, PS §206 and 207(a) and finally PCP 130(a). The uploaded documents comply with the requirements of PCP §138.

VVS:

3. Compliance of monitoring activities with the registered monitoring plan

Verification requirement:

233. The DOE shall determine whether the monitoring of parameters related to the GHG emissions reductions in the project activity has been implemented in accordance with the monitoring plan contained in the registered PDD or any accepted revised monitoring plan.

Project Standard:

2. Temporary deviations from the registered monitoring plan or applied methodology

206. If project participants are temporarily unable to monitor the registered CDM project activity in accordance with the registered monitoring plan or the applied methodology, project participants shall describe the nature, extent and duration of the non-conforming monitoring and the proposed alternative monitoring of the project activity in the monitoring report.

207. In such cases, project participants shall either:

(a) Inform the DOE contracted to perform a verification for the monitoring period during which they were unable to monitor the registered CDM project activity in accordance with the registered monitoring plan or the applied methodology;
Project Cycle Procedure:

1. Submission of request for approval of changes

130. A request for approval of changes may be submitted in respect of the following changes that have occurred or are expected to occur to a registered CDM project activity or PoA:
(a) Temporary deviation from the monitoring plan as described in the registered PDD, PoADD, generic CPA-DD, or the monitoring methodology;

138. The request for approval of changes shall contain:
(a) A duly completed Post-registration changes request form. (F-CDM-PRC);
(b) An assessment opinion on the changes by the DOE prepared in accordance with the Clean development mechanism validation and verification standard;
(c) Revised PDD, or revised PoA-DD and revised generic CPA-DD (in both clean and trackchange versions), as applicable;
(d) Letters of approval by the DNAs of the additionally included host Parties in the CDM PoA, as applicable;
(e) Supplemental documentation, as appropriate.

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 monitoring plan.
2 METHODOLOGY

The project assessment aims at being a rule based approach and is based on the methodology developed in the Validation and Verification Standard.

2.1 Appointment of the Assessment Team

According to the technical scopes and experiences in the sectoral or national business environment TÜV SÜD has composed a project team in accordance with the appointment rules of the TÜV SÜD certification body "climate and energy". The composition of an assessment team has to be approved by the Certification Body ensuring that the required skills are covered by the team. The Certification Body TÜV SÜD operates four qualification levels for team members that are assigned by formal appointment rules:

- Assessment Team Leader (ATL)
- Validator (V)
- Validator Trainee (T)
- Technical Expert (TE)

It is required that the sectoral scope(s) and the technical area(s) linked to the methodology and project have to be covered by the assessment team.

Assessment Team:

<table>
<thead>
<tr>
<th>Name</th>
<th>Qualification</th>
<th>Coverage of scope</th>
<th>Coverage of technical area</th>
<th>Host country experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Mahmood, Khalid</td>
<td>ATL</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Mr. Agrafiotis, Georgios</td>
<td>V</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Mr. Syed Mahmood, Ali Bukhari</td>
<td>TE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Technical Reviewers:
Mr. Mitterwallner, Robert
Mr. Kleiser, Thomas

2.2 Review of Documents

The PDD with the temporary changes from the registered monitoring plan submitted by the client and additional background documents like historical raw data were reviewed as initial step of the validation process.

2.3 Follow-up Interviews

According to and as a result of the document review as well based on several telephone conversations with the PP, TÜV SÜD discussed with the project participants the temporary changes from the registered monitoring plan.
2.4 Internal Quality Control

As final step of a validation, the validation report has to undergo and internal quality control procedure by the Certification Body “climate and energy”, i.e. each report has to be approved either by the head of the certification body or his deputy after approval of the Technical Reviewer. In case one of these two persons is part of the assessment team approval can only be given by the other one.

It rests at the decision of TÜV SÜD’s Certification Body whether the PDD with the temporary changes from the registered monitoring plan will be submitted for approval by the EB or not.

3 SUMMARY OF FINDINGS

The monitoring plan contained in the registered PDD (dated 18-03-2010, version 1.3) will be temporarily applied in a different way during the first monitoring period due to the following reasons:

AMS-III.Q. “Waste Energy Recovery (gas/heat/pressure) Projects”, ver. 2 requires that the capping factors are calculated as per ACM0012. For \( f_{\text{cap}} \) the project selected Method-2 of the methodology, which allows for:

- indirect measurement of waste heat in the baseline (based on the amount of clinker produced \( Q_{\text{BL, production}} \) and the amount of waste energy per unit of waste heat generated by the kiln \( q_{\text{wcm,product}} \)) and
- requires the direct measurement of the waste heat carrying medium in the project scenario.

Therefore, in the approved monitoring plan, the quantities of WECM after the CDM project implementation \( (Q_{\text{WCM, preheater, } y} \text{ and } Q_{\text{WCM, clinker cooler, } y}) \) are required to be monitored on a continuous basis using waste gas flow meters installed at each entrance of WECM into the heat exchanger for steam generation.

During the first monitoring period, the on-line Waste Gas Flow meters at project site could not be installed due to delayed delivery. Thus the project participant could only implement the waste gas flow meters on 17/01/2012, which is the beginning of the second monitoring period. Hence, the deviation is needed only for monitoring of quantity of the Waste Energy Carrying Medium in absence of the waste gas meters in the first crediting period from 28/08/2010 to 16/01/2012.

Based on the above, it is concluded that the application of Method-2 of ACM0012, ver. 4 in its fullness is not possible during the first monitoring period. Therefore, the project participant proposes in this request of prior approval of temporary post registration changes to calculate \( Q_{\text{WCM, } y} \) indirectly (and without separately calculating the values of \( Q_{\text{WCM, preheater, } y} \) and \( Q_{\text{WCM, clinker cooler, } y} \)) from the amount of clinker produced during the monitoring period. In the proposed alternative approach, the generated waste heat can be estimated as the product of the amount of clinker produced during the monitoring period \( Q_{\text{product, } y} \) and the amount of waste heat per unit of product generated \( q_{\text{wcm,product}} \), according to the formula below:

\[
Q_{\text{WCM, } y} = Q_{\text{product, } y} \times q_{\text{wcm,product}}
\]

Where:

| \( Q_{\text{WCM, } y} \) | Quantity of waste energy generated in year \( y \) (Nm\(^3\)/yr) |
| \( Q_{\text{product, } y} \) | Production of clinker during the monitoring period (t) |
| \( q_{\text{wcm,product}} \) | Amount of waste energy per unit of product generated by the process (that generates waste energy in the facility) (Nm\(^3\)/t) |
The amount of clinker produced is measured as part of the production process. The parameter \( q_{wcm, \text{product}} \) is based on the manufacturer’s specification and is already used in the baseline calculations in the registered PDD. As the project implementation has not lead to any modification of the waste heat generation process itself in the kilns, the same value of the parameter can be used during the project year “y” exactly as during the baseline scenario (see the table for \( q_{wcm, \text{product}} \) in “Data and parameters not monitored” in ACM0012, ver.4). As this default parameter provides the value of waste heat generated per ton of clinker and not the amount of waste heat captured or utilized, the approach is conservative and would not lead to overestimation of the emission reductions. Thus the proposed deviation constitutes only a deviation from the registered monitoring plan, but follows the guidance for the calculation of \( f_{\text{cap}} \) as provided in ACM0012 (ver.4).

### Additional parameter to be monitored during the first MP:

<table>
<thead>
<tr>
<th>Data/Parameter</th>
<th>Unit</th>
<th>Description</th>
<th>Measured/Calculated/Default</th>
<th>Source of data</th>
<th>Value(s) of monitored parameter</th>
<th>Monitoring equipment</th>
<th>Measuring/Recording frequency</th>
<th>Calculation method (if applicable)</th>
<th>QA/QC procedures</th>
<th>Purpose of data</th>
<th>Additional comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Q_{\text{product,y}} )</td>
<td>ton</td>
<td>Production of clinker during the monitoring period</td>
<td>measured</td>
<td>Plant production records</td>
<td>2,044,957 (calculated value based on the actual production, see additional comment below)</td>
<td>Scales</td>
<td>Measured continuously, readings taken each shift</td>
<td>N/A</td>
<td>The scales undergo regular calibrations as per Pakistani national standards</td>
<td>Calculation of project emissions</td>
<td>The value is based on 2,840,530 ( t_{\text{clinker}} ) produced over the 507 calendar days of the period 28/08/2010-16/01/2012.</td>
</tr>
</tbody>
</table>

The proposed deviation follows the procedures as they described in ACM0012 (ver. 4), Method-3 for the calculation of \( f_{\text{cap}} \).
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The value of waste heat $8.88 \times 10^9$ Nm$^3$/yr is based on manufacture’s specifications (Doc 1 Heat balance), which state directly the amount of waste heat that is emitted out of the kilns. Based on that, it is not necessary to multiply the clinker production with the parameter $q_{wcm,product}$ in order to calculate the waste heat in the baseline. On the contrary, it is possible to calculate this parameter in a reliable way by deviding the waste heat with the clinker production.

The amount of waste heat as per manufacturer represents three different waste heat flows (Doc 2 flow diagram-Model): The waste heat out after the pre-heater of a kiln (as shown in the technological scheme of the project activity at Page 6 of the registered PDD) which is estimated to be 306,000 Nm$^3$/hr and the waste heat flow out from the clinker cooler of a kiln and which is estimated to be 311,000 Nm$^3$/hr (Sum of 189,100-AQC output 1 and 121,900-AQC output 2). So the estimated quantity of waste heat sums up to 306,000+311,000=617,000 Nm$^3$/hr per kiln. Thus the total volume during a year results to 617,000 x 2 (No. of kilns) x 24 (hours) x 300 (operational days) = 8,884,800,000 = 8.88 x 10$^9$ Nm$^3$/yr.

The clinker production of one kiln during the baseline scenario as per the registered PDD was 5,700 tons per day (TPD) and considering 300 operational days in a year, the clinker production during a year comes to 5700 (TPD) x 2 (No.of kilns) x 300 (operational days) = 3,420,000 tons /year.

The value 2,598 Nm$^3$/ ton of clinker (see page 23 of the PDD) is calculated by dividing value $8.88 \times 10^9$ Nm$^3$/yr (see page 22 of the PDD) by the value 3.42x10$^6$ (see page 22 of the PDD).

During the first monitoring period, the project operated at much lower load (2,044,957 t_clinker/yr) than in the baseline described in the PDD (3,420,000 t_clinker/yr) and the amount of waste energy (heat) generated is below the baseline waste energy level. The calculations of $f_{cap}$ using actual data from the monitoring period is shown below:

$$f_{cap} = \frac{Q_{WCM, BL}}{Q_{WCM, y}} = \frac{8.88 \times 10^9 \text{Nm}^3}{5.31 \times 10^9 \text{Nm}^3} = 1.67 > 1$$

Where,

$$Q_{WCM, y} = Q_{producty} \times q_{wcm,product} = 2,044,957 \text{ t_clinker} \times 2,598 \text{ Nm}^3/\text{t_clinker} = 5.31 \times 10^9 \text{Nm}^3$$

Therefore,

$$f_{cap} = 1$$

Finally, it has to be stated again that the deviation is required only for the first monitoring period, as waste gas flow meters were installed at the project site as mentioned in the commissioning certificate issued by manufacturer/supplier of the flow meters dated 17/01/2012.

Assessment of the DOE that the deviation does not require a revision of monitoring plan of the project activity as described in the registered project design document.
TÜV SÜD considers the PDD with the temporary changes from the registered monitoring plan as acceptable and reasonable. The PDD with temporary changes from the registered monitoring plan reflects the reality and complies with AMS III.Q, version 4.

This proposed deviation from the registered monitoring plan does not require a revision of the monitoring plan which is described in the registered PDD, as the deviation is a temporary non-compliance during the first monitoring period from 28/08/2010 to 16/01/2012. According to the project participants, from 17/01/2012 onwards the necessary equipment for direct measurements of the waste heat have been installed. This will be checked during the on-site audit at the first verification for the ERs of the above mentioned period.

Applying the same method to calculate $Q_{WCM,y}$ as done for $Q_{WCM,BL}$ is reliable and conservative. The calculation will be done based on:

1) actual values of clinker production during the respective monitoring period and
2) the parameter $q_{wcm,product}$ of waste heat production per ton of clinker that was used in the PDD for the baseline scenario.

This parameter was once calculated in the registered PDD and shall remain in this range throughout the crediting period, under the condition that the kiln will not be modified and the combustion process will be continued in the same way. Depending on the applied fuel for the combustion of limestone to produce clinker the waste heat quantity per unit of clinker might vary. Thus TÜV SÜD asked from the PP the protocols of fuel use before and after the commissioning of the WHR plant. During the validation it was evidenced that the WHR plant was commissioned on 16.7.2009 (IRL 38). The use of coal in the baseline scenario was proved by the balance sheet (IRL 51). The continuation of use of coal is proved in the context by the invoices from several months before (Doc 4 Coal invoices (CDM)) and after (Doc 5 Coal invoices (July-Sept. 2009)) the commissioning of the CDM project. The fuel remains coal. Additionally TÜV SÜD received an official statement (Doc 3 Official confirmation of coal use) from the PP stating that no modification in the calcination process has taken place.

The DOE confirmed the calculated $q_{wcm,product}$ based on its technical experience and by the information in the “Best Available Reference Paper of Clinker and Lime Production, 2010, EU” Furthermore this parameter is influenced neither by the implementation of the CDM project nor by the equipment used to measure the waste heat.

The concept of $f_{cap}$ aims in avoiding that PPs claim more CERs than in the baseline scenario due to higher quantities of waste heat which are a result of deliberately increased production. By applying the same value for the parameter $q_{wcm,product}$ this risk is eliminated because in the end only the two production values (baseline and project year "y") remain in the ratio: if the clinker production during the project year is lower than in the baseline, then $f_{cap}=1$. If the clinker production is higher (which would lead to more waste heat, more electricity generation and finally more CERs) then $f_{cap}$ will be respectively reduced.

This request for deviation contains the actual value of clinker production, exactly as it will be presented in the monitoring report in the context of the first request for issuance. This fact enhances the credibility of the request.

The request is complying with the VVS §233, PS §206 and 207(a) and finally PCP 130(a). The uploaded documents comply with the requirements of PCP §138.
4. VALIDATION OPINION

TÜV SÜD has performed a validation of temporary changes from the registered monitoring plan of CDM Project 3555:
“Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan”

The review of the temporary changes from the registered monitoring plan and the subsequent follow-up interviews has provided TÜV SÜD with sufficient evidence to determine the fulfillment of all stated criteria. In our opinion, the temporary changes from the registered monitoring plan meets all relevant UNFCCC requirements as per the Validation and Verification Standard (version 2.0).

It can be confirmed that:

a. the level of accuracy and completeness in the monitoring and verification process is not reduced as a result of the revision, also can be confirmed that the temporary changes from the registered monitoring plan are in accordance to the project activity.

b. the temporary changes from the registered monitoring plan are in accordance with the approved monitoring methodology applicable to the project activity.

This proposed deviation from the monitoring plan does not require a revision of monitoring plan or the changes from the project activity as described in the registered PDD, as the deviation is temporary non-compliance and is only for the first monitoring period.

Based on the work described in this report, nothing has come to our attention that causes us to believe that any project component or issue has not been covered by the validation process.

Munich, 02-11-2012

__________________________________
Thomas Kleiser
Head of the Certification Body
“climate and energy”
TÜV SÜD Industrie Service GmbH

Munich, 02-11-2012

__________________________________
Khalid Mahmood
Assessment Team Leader